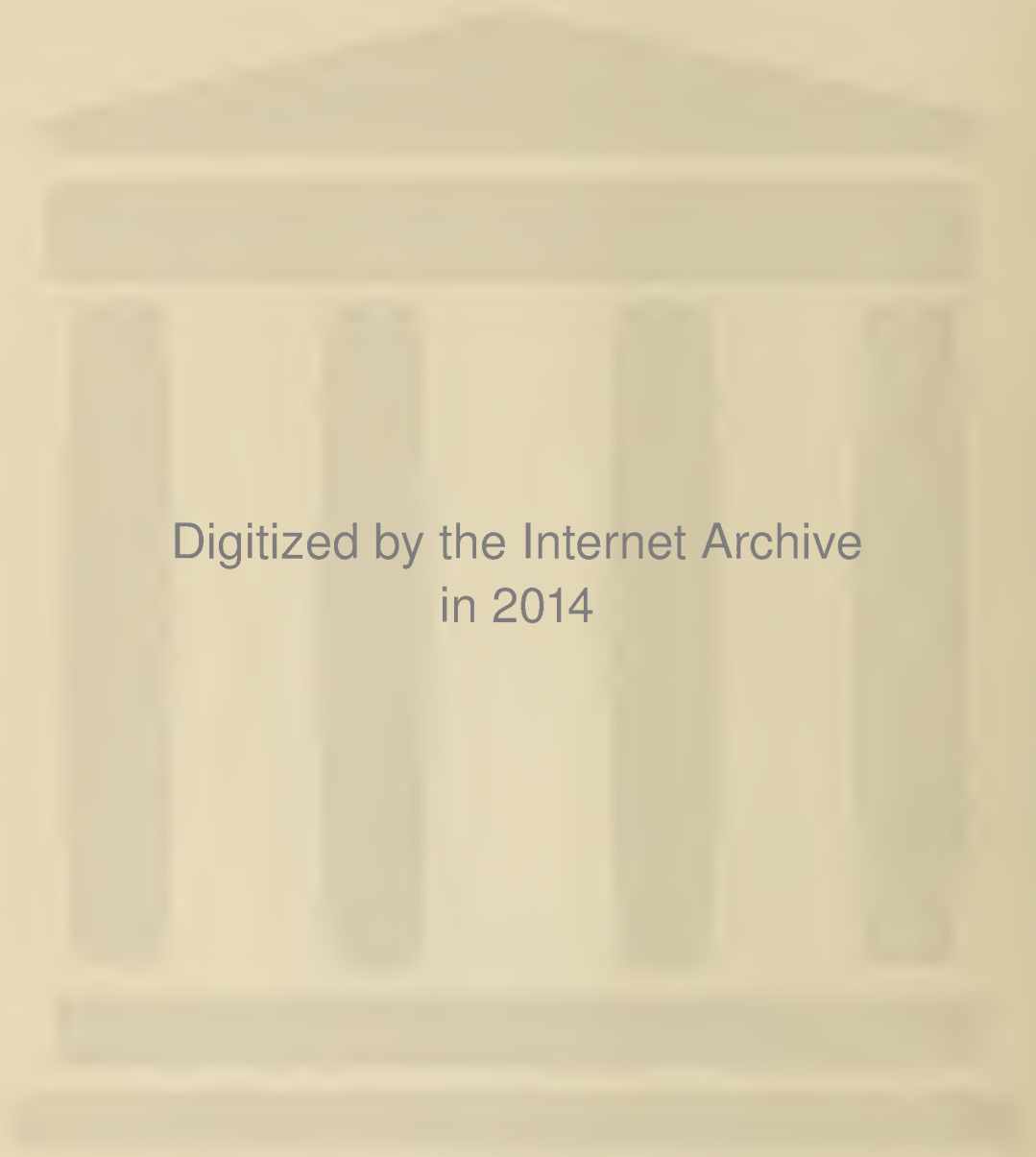
OCT 7 1965
LIBRARY

Return to
LIBRARY
NATIONAL RESEARCH
PUBLICATIONS LIMITED


Digitized by the Internet Archive
in 2014

https://archive.org/details/canminingjjanjun1914donm

INDEX

Canadian Mining Journal, Vol. 35

JANUARY 1st, 1914 TO DECEMBER 31st, 1914

MINES PUBLISHING CO., LIMITED

44-46 Lombard Street

TORONTO

INDEX

CANADIAN MINING JOURNAL, VOL. 35

JANUARY 1st, 1914, TO DECEMBER 31st, 1914

A

Ablett, Antony C, on Electrical Driving of Winding Engines and Rolling Mills, 223, 265.*

Accidents, Causes And Prevention of Tunnel, by D. W. Brunton and J. A. Davis, 513, 546.

Accidents From Explosives, 308.

Accidents In British Columbia Mines, Fatal, 747.

Accidents In Metal Mines In U. S., 739.

Accidents In The United States, Coal Mine, 28.

Accidents In British Columbia, Mine, 362.

Accidents In British Columbia Mines, Fatal, 522.

Accidents in Ontario, Mining, 349.

Adams, F. D., on Natural Resources of Canada, 419.

Alaska Gold, 800.

Alaska Solomon Derby Dog Race, 395.

Alaska-Yukon Railway, 222.

Alberta In 1913, Coal Mining In, by John T. Stirling, 763.

Alberta Oil, 361. E.

Alberta Oil, 229, 267.

Alberta Oil Companies, 375.

Alberta, Oil Discovered At Great Depth In, 370.

Alberta—Special Correspondence, 560.*

Albion Mines, Nova Scotia, Fighting Fire At, 761.*

Alexander, Magnus W., on First Aid Treatment of Injured Persons, 798.

Alexo Nickel Mine, 782.

Algoma Steel, 768.

Algoma Steel Corporation, 318.

Asbestos, 173.

Asbestos Corporation of Canada, 183.

Asbestos, Russian, 370.

Amalgamating In Cyanide Solution, A Successful Method of, 300.*

American Institute of Mining Engineers, 146. E.

American Institute of Mining Engineers, Annual Meeting, 138.

American Institute of Mining Engineers, Butte Miners And The, 163.

American Mining Congress, 728.

American Mining Institute Meeting, 591.

Aluminum, 384.

Analyses of U. S. Coals, 773.

Anderson, Alexander, on Electrical Training for Mining Engineers, 242.

Anderson, Edgar P, on Percentage Recovery In Ore Dressing, 97.

Anglo-French Exploration Co., The, 372, 564.

Annual Meeting, 605.

Annual Meeting, American Institute of Mining Engineers, 138.

Annual Meeting, 1914, Canadian Mining Institute, 76 and 184.

Annual Meeting Canadian Mining Institute, 109. E.

Annual Meeting of The Mining Society of Nova Scotia, The Twenty-Second, 291.

Anthracite, Pennsylvania, 60.

Annual Report of The Granby Consolidated Company, 27*.

Annual Report, 1913, Hollinger Gold Mines, 121.*

Annual Report Granby Consolidated Mining, Smelting & Power Company, 707.*

Annual Report Kerr Lake Mining Company, 713.

Annual Report Peterson Lake, 367.

Annual Report of The Minister of Mines For British Columbia, 519.

Annual Report of Nipissing Mines Co., 1913, 295.*

Annual Report of Van-Roi Mining Co, Ltd., 345.

Application of Kick's Law to the Measurement of Energy Consumed In Crushing The, by S. J. Speak, 623.

Archean Geology of Rainy Lake, The, 654.

Armstrong-Whitworth & Co., Plant Of, 412.

Asbestos As a Building Material, 712.

Asbestos In Southern Quebec, 600.*

Assaying Cobalt Silver Ores, 666.

Atlin District, Ore Deposits Of, by D. D. Cairnes, 449.

B

B. & A. Asbestos Co., 96.

Bailey—Cobalt, 448, 749.

Baltic Mining Methods, 796.*

Barlow, A. E.—Obituary, 398.

Bartram R Sydney, On Rhymes of the Re-Survey, The, 800.

Basins of Nelson and Churchill Rivers, The, 112.

Bathurst Mines, New Brunswick, Iron Ore Deposits, by G. A. Young, 339.

Beaver, 169.

Beaver Lake, 318 and 503.

Beaver Mine, Cobalt, Ont., Hoist Recently Installed At, 352.*

Beaver Lake Mining District, Saskatchewan, 504.

Beaver Mine, New Hoist For, 175.

Belgian Test, Hailwood Lamps Pass, 96.

Belgians, The, 567.

Beneficial Results of the Work of the United States Bureau of Mines, 804.

Bethlehem Steel Corporation, 727.

Blairmore-Frank District, 531.

Book Reviews—Compressed Air Practice, by Frank Richards, 24; Economic Geology, by Chas. H. Richardson, 24; Colliery Manager's Pocket Book, by Hubert Greenwell, 24; Canadian Trade Index, 24; Heaton's Annual, 102; First Aid in Mining, by Louis G. Irvine, 102; First Aid, by Major Charles Lynch, and Lieut. M. J. Shields, 102; Metal Statistics, 1914, 112; Manual of Hydraulic Mining, by T. F. Van Wagenen, 112; Copper Handbook, by W. H. Weed, 174; Mining Manual and Mining Year Book, by Walter R. Skinner, 174; The Electric Furnace, by Alfred Stansfield, 174; Igneous Rocks and Their Origin, by Reginald Aldworth Daly, 174; Mine Sampling and Valuing, by C. S. Herzig, 278; Details of Cyanide Practice, by Herbert A. Megraw, 279; Lindley on Mines, by Hon. Curtis H. Lindley, 315; Mining World Index of Current Literature by Geo. E. Sisley, 315; Text Book of Geology, A, by James Park, 348; Compressed Air, by Theodore Simons, 348; Engineering Geology, by Heinrich Ries, 431; Metallurgy of Copper, by H. O. Hofman, 456; Chemical Reagents, Their Purity and Tests, by E. Merck, 524; Iron Ores of Lake Superior, by Crowell and Murray, 622; Recent Copper Smelting, by Thos T. Read, 622; Crystallography, by T. L. Walker, 622; Handbook of Milling Details, Eng. and Mining Journal, 622; Useful Minerals and Rare Ores, by Alex. McLeod, 622; The Mining World Index of Current Literature, by Geo. E. Sisley, 622; Iron Ores, Their Occurrence, Valuation and Control, by Edwin C. Eckel, 750; Mineral Industry, Its Statistics, Technology and Trade, During 1913, The, by G. A. Roush, 750; Modern Tunneling, by D. W. Brunton and J. A. Davis, 750; Unit Construction Costs, From the New Smelter of the Arizona Copper Co., Ltd., by E. Horton Jones, 750; Electricity In Coal Mining, by David R. Shearer, 784.

Borden, Sir Robert, 574.

Bore-Hole Records And Capping of Gas Wells, Importance Of, by W. J. Dick, 543.

Bounties On Mineral Production, 54.

Brass Industry, The United States, 536.

Brazeau Collieries, 287 and 372.

Brazil, Iron Ore In Michigan and, 4.

Breathing Apparatus, Oxygen, by F. W. Gray, 13.

Breathing Apparatus, The Present Status of Oxygen, by F. W. Gray, 154.

Breathing Apparatus With And Without Injectors, Oxygen, by Dr. Ing. Forstmann, translated by F. W. Grey, 14.*

Britannia Mines, B.C., 112.

British Columbia Mines, Fatal Accidents In, 747.

Brief Comparison of Methods and Conditions In The Witwatersrand & Lake Superior Districts A, by L. B. Hingle, 481.*

British Columbia, 317.

British Columbia, Annual Report of The Minister of Mines For, 519.

British Columbia Copper Company, 135, 158, 639.

British Columbia In 1913, 74. E.

British Columbia In 1913, by E. Jacobs, 46.

British Columbia In 1913, Coal Mining In, by E. Jacobs, 48.

British Columbia Coal Commissioners' Report, 166.

British Columbia, Mine Accidents In, 362.

*—Illustrated.
E—Editorial.

British Columbia, Special Correspondence, 31, 68, 103, 140, *177, 214, 249, *280, 321, 356, 392, 428, 465, *494, *528, 560, 594, 625, 655, 690, 721, 753, 786, 809.
Brock To Be Deputy Minister, R. W., 38. E.
Brown, J. F. K., on Longwall Machine Mining, 435.
Bruce, Everend L., on Microscopic Tests on Opaque Minerals, 748.
Brunton, D. W., 611.
Brunton, D. W., on Causes and Prevention of Tunnel Accidents, 513, 546.
Bryce, on German Methods, 747.
Building And Ornamental Stones of The Maritime Provinces, 541.
Burns, C. H. McL., on Methods of Working A Three Coal Seam At Joggins, N.S., 537.*
Burnside Claims, 236.
Business as Usual on the Rand, 664.
Butte An Open Camp Now, 617.
Butte Miners And The American Institute of Mining Engineers, 163.
By-Product Coke Ovens, 315.
By-Product Coke Ovens of the Algoma Steel Co., Sault Ste. Marie, Ont, by W. J. Dick, 487.
Byers-Galvanizing Plant, 691.

C

Cairnes, D. D., on The Chisana (Shushanna) Gold District, 9; on Placer Mining in the Klondike, 156; on Ore Deposits of Atlin District, 449.
Calgary Oil Field, 397. E.
Calgary Oil Field, 632.
Calgary Oil Flotations, 469. E.
California Gold, 817.
California Oil, 443.
Calumet & Hecla, 424. 484, 489, 617, 818.
Calumet & Hecla Regrinding Plant, 365-366. E.
Calumet & Hecla Tailings With A Hydraulic Dredge, Reclaiming, 729.*
Campbell, E. G., on Kirkland Lake Ores, 631.
Camsell, Chas., on Ore Deposits of The Similkameen District, B.C., 309.*
Canadian Building at Panama-Pacific Exposition, 137.
Canadian Coal and Coke, 384.
Canadian Coal & Coke Co., 615.
Canadian Collieries Limited, vs. Dunsmuir, 531.
Canadian Contribution to the Medical Service In the Great European War, The, by Colonel G. Sterling Ryerson, 733.
Canadian Copper Co.'s Department of Safety, by E. T. Corkill, 610.
Canadian Copper Co., Rock House, At No. 3 Mine, 382.*
Canadian General Electric Co.'s Corps, 654.*
Canadian Klondike, 803.
Canadian Mining Corporation, 772.
Canadian Mining Exhibit At the Panama-Pacific International Exposition, 398.
Canadian Mining Institute, 219. E.
Canadian Mining Institute, 110, 595, 813.
Canadian Mining Institute Annual Meeting, 76.
Canadian Mining Institute, Annual Meeting, 1914, 184.
Canadian Mining Institute Headquarters, 73. E.
Canadian Mining Institute, Rocky Mountains Branch, 188.
Canadian Mining Institute, The, 145.* E.
Canadian Mining Institute, Western Branch, 65, 187, 446.
Canadian Mining Societies, 694. E.
Canadian Northern Railway Mount Royal Tunnel, 164.
Canadian Northern Railway Mount Royal Tunnel, by D. J. O'Rourke, 128.*
Canadian Oil Fields, 364.
Canadian Peat Co., 326.
Canadian Route to Chisana (Shushanna), Alaska, 45.
Caribou District, 215.
Casey, Cobalt, 38.
Causes And Prevention of Tunnel Accidents, by D. W. Brunton and J. A. Davis, 513, 546.
Caving System In The Lake Superior Dist., The, 609.
Cement, 8.
Cement Grout, Checking the Flow of Water Into Shafts By the Use Of, by Francis Donaldson, 165.
Cementing Oil And Gas Wells, by I. N. Knapp, 405.
Centrifugal Compressors, by Louis Loewenstein, 679.*
Centrifugal Compressors, by A. Willcocks, 760.
Chambers-Ferland, 418.
Changes At Queen's, 817.
Chappell, Henry, on The Day, 632.
Characteristics of Gold Deposits of Kewagama Lake District, Que., 682.
Checking The Flow of Water Into Shafts By The Use of Cement Grout, by Francis Donaldson, 165.
Chisana (Shushanna) Alaska, Canadian Route To, 45.
Chisana (Shushanna) Gold District, The, by D. D. Cairnes, 9.
Chrome Iron Ore, 456.
Classification Of Igneous Rocks, The, 219.
Clays and Clay Products, 54.
Clay and Shale Deposits of The Western Provinces, 567.
Clay Deposits of New Brunsmick, 505.
Clevenger, G. H., on The Mill and Metallurgical Practice of The Nipissing Mining Co., Ltd., Cobalt, Ont., 555.
Coal at Tulameen, British Columbia, 806.
Coal Cutters, 486.
Coal Dust Investigation, 346.
Coal Fields, Hidden, by F. W. Gray, 364.
Coal Fields, The Exhaustion of U. S., 815.
Coal In Canada, Conservation Of, 311.
Coal Mine, A Portable Sub-Station For A, 34.*
Coal Mine Accidents In the United States, 28.
Coal Mine Disaster In South-West Alberta, The, 488.
Coal Mine Explosions Caused By Gas Or Dust, 728.
Coal Mines, Electricity In, by John Liston, 640.*
Coal Mining In Alberta In 1913, by John T. Stirling, 763.
Coal Mining In British Columbia In 1913, by E. Jacobs, 48.
Coal Mining Practice In Illinois, 816.
Coal Mining, Supervision Of, 521.
Coal Seam at Joggins, N.S, Methods of Working A Thin, by C. H. McL. Burns, 537.
Coal, The Origin Of, 658.
Coal Trade of Nova Scotia In 1913, The, by F. W. Grey, 40.
Coals, Analyses Of U. S., 773.
Coals, Tar Forming Temperatures of American, 521.
Cobalt And Its Alloys, The Metal, by H. T. Kalmus, 11.
Cobalt Combine, The, 220.
Cobalt, From Belgian Congo, 639.
Cobalt Frontenac, 126.
Cobalt Shipments, 35, 69, 107, 143, 173, 211, 251, 287, 359, 395, 431, 627, 639, 782, 814.
Cobalt Silver District In 1913, Ore Shipments From, 98.
Cobalt Silver Mines, 470. E.
Cobalt Silver Mining Companies Plan New Work, 630. E.
Cobalt Silver Ores, Smelting The, by A. A. Cole, 20.
Cobalt, Special Correspondence, *29, 66, 106, 141, 176, 212, *248, 285, 320, *322, 358, 394, 430, 463, 497, 525, 562, 592, 656, 689, 722, 754, 785, 808.
Cobalt Townsite, 39.
Coke Ovens, By-Product, 315.
Cole, A. A., on The Mining Industry In Relation to The Temiskaming and Northern Ontario Railway, 294; on Smelting The Cobalt Silver Ores, 20.
Coleman, A. P., on The Massey Copper Mine Area, 378.
Collieries Case, 472.
Colliers' March, The, by E. W. Gray, 779.
Collins, W. H., on Gowganda Silver Deposits, 168.
Colorado Strike, 683.
Colorado Strike, The, 610.
Colorimetric Estimation of Gold In Cyanide Solutions, 512.
Commercial Uses for Peat, by Arthur J. Forward, 743.
Commission of Conservation, 767.
Comparison of Mining Conditions In The United States To-Day With Those of 1872, by R. W. Raymond, 159
Composition of Natural Gas, The, by G. R. Mickle, 740.
Compressed Air In Cyanidation, The Use Of, by Herbert A. Megraw, 92.
Concentrates, 2. E.
Concentration And Cyanidation of Cobalt Silver Ores, 182. E.
Concentration In Connection With Cyanide Treatment of Low Grade Ores, 732.
Conditional Contrabrand, 694. E.
Congress of Applied Chemistry, 492.
Coniagas, 716.
Conservation of Coal In Canada, 289.
Conservation of Coal In Canada, 311.
Consolidated Mining & Smelting Co., of Canada, The, 18, 340.
Constant Volume Generator, A, 731.*
Construction of Cages, The, 338.
Copper, 617, 634, 755.
Copper Deposits, Michigan, by R. E. Hore, 170.*
Copper Export Situation, 814.
Copper, From Nickel Separtion Of, 801.
Copper Handbook, The, 237.
Copper Leaching and Electrolytic Precipitation At Chuquicamata, Chile, by E. A. Cappelen Smith, 341.
Copper Mine Area, The Massey, by A. P. Coleman, 378.
Copper Quotations, 535.
Copper Report, 183.
Copper Seizures, 814.
Copper Shippers Protest, U. S., 751.
Copper Smelting In Canada, 662. E.
Copper Sulphides, Monell Method of Separating Nickel and, 85.
Copper, The Mond Process of Separating Nickel and, 306.*
Cordova Mine, 318.
Corkill E. T., on Can. Copper Co.'s Dept. of Safety, 610.
Correspondence, Brown, Thos. J., 76; Lamb, H. Mortimer, 148; Spearman, Chas., 362; Slocan, David, 398; Willcocks, A., 760; Campbell, E. G., 631.
Corundum, 8.
Coste, Eugene, on Rock Disturbances, Theory of Petroleum Emanations, vs. The Anticlinal or Structural Theory of Petroleum Accumulations, 647; on The Volcanic Origin of Petroleum, 473.
Craft, Walter N., on The Electric Furnace for Steel Making, 684, 717.
Crown Reserve, 302, 326, 772.
Crow's Nest Pass Coal Co., 267.

Cyanidation, The Use of Compressed Air In, by Herbert A. Megraw, 92.
Cyanide. Imports Of, 816.
Cyanide Precipitate, Smelting Furnace For, 440.
Cyanide Production In U. S., 657.
Cyanide Solution, A Successful Method of Amalgamating In, 300.*
Cyanide Supply, The, 806.
Cyanide Treatment of Low Grade Ores Concentration In Connection With, 732.
Cyaniding Silver Ores At Nipissing Mine, Cobalt, by Jas. Johnston, 99.*

D

Daily Financial Paper, A, 326. E.
Dane Mining Co., 323.
Davis, J. A., on Causes and Prevention of Tunnel Accidents, 513, 546.
Dawson, J. A., on Graphite In Gold Ore From Kirkland Lake District, Ont, 578.
De Launay, M., on The Formation of Metalliferous Deposits, 385.
Deloro Gold Claims Sold, 287.
Denis, Theo. C., on Mineral Industry of the Province of Quebec, 1913, 44; on Mineral Production of Quebec In 1913, 265.
Department of Mines Publications, 326.
Deputy Minister of Mines Resigns, 566. E.
DeSollar, T. C., on Rock-House Practice of The Quincy Mining Company, 51.*
Determination of Properties of Petroleums, 411.
Devlin, Hon. C. R., the Late Minister of Colonization And Mines of The Province of Quebec, 219.
Dick, W. J., on Importance of Bore-Hole Records and Capping of Gas Wells, 543; on By-Product Coke Ovens of The Algoma Steel Co., Sault Ste. Marie, Ont., 487.
Dickinson E. S., On Mining Iron Ore, 780.
Disaster In South-West Alberta, The Coal Mine, 488.
Dividends of American Mines and Works, 813.
Dividends Paid By Ontario Mining Companies In 1913, 39.
Dome, 448, 706, 731.
Dome Lake, 367.
Dome Mill, The, 304.*
Dome Mine, Mining Gold Ore At The, 75.*
Dome Mine, South Porcupine, Ontario, The Treatment of Gold Ore At, by D. L. H. Forbes, 77.
Dome Mines, Annual Report, 327.*
Dome, Special Correspondence, 45.
Dominion Assay Office, Vancouver, B.C., 318.
Dominion Coal Co., Ltd., The, 579.*
Dominion Steel, 204, 634.
Dominion Steel & Coal, 174.
Dominion Steel Co. Has Big Order, 445.
Donaldson, Francis, on Checking The Flow of Water Into Shafts By The Use of Cement Grout, 165.
Dowling. D. B., on Sheep River Gas And Oil Field. Alberta, 399.*
Dr. Adams Honored By Tuft's College, 462.
Drainage of Kerr Lake Discloses Rich Ore, The, 472.*
Draining of Kerr Lake, 301.*
Drawing Pen, A New, 471.
Drill, The Modern Rock, by W. L. Saunders, 25.
Dunsmuir Collieries, 229.

E

Economic Minerals & Mining Industries In Canada, 182. E.
Eight-Hour Shift, The, 146. E.
Electric Furnace For Steel Making The, by Walter N. Craft, 684, 717.
Electric Power From Anthracite Culm, 512.
Electric Smelting of Canadian Iron Ores, by T. R. Loudon, 150.*
Electrical Driving of Winding Engines And Rolling Mills, The, by C. Antony Ablett and H. M. Lyons, 223, 268.
Electrical Equipment of Oil Wells, 657.
Electrical Installations, Safety on Underground, The, by C. M. Means, 620.
Electrical Training for Mining Engineers, by Alexander Anderson, 242.
Electricity In Coal Mines, by John Liston, 640.*
Electro-Metallurgy of Steel, The, 244.
Electrolytic Precipitation at Chuquicamata, Chile, Copper Leaching And, by E. A. Cappelen Smith, 341.
Elk Lake, Special Correspondence, 29, 66, 141, 176, 248, 285, 320, 430, 463, 497, 722, 808.
Elliott, S. R., on Storage and Measuring Pockets at Negaunee Mine, 22.*
Ellis, Dr. W. H., 688.*
Emmons, Wm. Harvey, on The Vertical Range of Metals Deposited by Secondary Processes, 353.
Employers' Liability, Correspondence, by H. Mortimer Lamb, 148.
Engineer, The, by H. E. T. Haultain, 793.
English for Engineering Students, 629. E.
Enter the Canadians, 744.
European Coal Fields, The War And, by F. W. Gray, 695.
Exhaustion of U. S. Coal Fields, The, 815.
Explosives, Accidents From, 308.
Explosions Caused by Gas or Dust, Coal Mine, 728.
Export of Nickel Matte, 757. E.
Express Co. Raises Rates, 678.
Extinguishing Mine Fires By Hydraulic Filling, 510.

F

Fatal Accidents n British Columbia Mines, 522, 747.
Feldspar, 19, 536.
Field Work of The Geological Survey During 1914, 368.
Fighters, The, 812.
Fighting Fire at the Albion Mines, Nova Scotia, 761.*
Fire Proof Roofing, 646.
First Aid Among Metal Miners In British Columbia, 608.
First Aid Treatment of Injured Persons, by Magnus W. Alexander, 798.
First Aid Trophy, 183. E.
First Large Deisel Engine For U. S., 652.*
Foley-O'Brien, 731.
Forbes, D. L. H., on The Treatment of Gold Ore at Dome Mine, South Porcupine, Ontario, 77.
Foreign Labor in the Mines, 726. E.
Foreign Workmen In the Mines, 535. E.
Formation of Metalliferous Deposits, The, by M. De Launay, 385.
Forstmann, Dr. Ing, on Oxygen Breathing Apparatus With And Without Injectors, 14.*
Forward, Arthur J., Commercial Uses for Peat, 743.
Fuller's Earth, 536.

G

Galbraith, The Late Dean, 551.
Galician Oil Fields, 652.
Gas and Oil Field, Alberta, Sheep River, by D. B. Dowling, 399.*
Gas And Oil Fields of New Brunswick, by Mathew Lodge, 201.*
Gas In New Brunswick, 503.
Gas Wells, Importance of Bore-Hole Records and Capping of, by W. J. Dick, 543.
Geological Survey, Canada, Recent Publications of The, 245.
Geological Survey During 1914, Field Work of The, 368.
Geological Survey For 1912, Summary Report of The, 490.
Geological Survey Publications, 346, 765, 814.
Geologists In Great Britain, The Training Of, 366.
Geology Along Yukon-Alaska Boundary, 802.
German Methods, Bryce, On, 747.
German Oil Supply, 819.
German Patents, 617.
German Reports, 762.
Germany, Krupp Grusonwerk Ore Testing Plant, Magdeburg, 70.*
Gibson, T. W., on Mineral Production of Ontario, 1913, 196.
Gold and Silver Mining In Northern Ontario, 298.*
Gold Deposits of Northern Ontario, 217. E.
Gold District, The Chisana (Shushanna), by D. D. Cairnes, 9.
Gold In Cyanide Solutions, Colorimetric Estimation Of, 512.
Gold In Ontario, The Occurrence Of, by J. B. Tyrrell, 230.
Gold Mine, Kirkland Lake, Ont, Tough-Oakes, 259.*
Gold Mine, Princess Royal Island, B.C., Surf Inlet, 379.
Gold Mining, 566. E.
Gold Mining At Kirkland Lake, 598. E.
Gold Mining At Porcupine and Kirkland Lake, Ont., by Ben Hughes, 635.*
Gold Mining in the City of Edmonton, Alta., 665.*
Gold Ore At Dome Mine, South Porcupine, Ontario, The Treatment Of, by D. L. H. Forbes, 77.
Gold Ore At The Dome Mine, Mining, 75.*
Gold Ore From Kirkland Lake District, Ont., Graphite in, by J. A. Dawson, 578.
Gold Ore In Depth, The Persistence Of, by Malcolm Maclaren, 88.
Gold Output of South Africa, 492.
Gold Pool, The, 634.
Gold Quartz Veins, Hollinger Mine, 173.*
Gold Thief Captured, 563.
Good Dividend Record, A, 488.
Gould, Chas., N., on The Occurrence of Petroleum And Natural Gas In The Mid-Continent Field, 485.
Gowganda Apex, 210.
Gowganda Silver Deposits, by W. H. Collins, 168.
Gowganda, Special Correspondence, 29, 66, 106, 141, 176, 212, 248, 285, 320, 358, 394, 430, 463, 497, 525, 562, 592, 656, 689, 722, 754, 785, 808.
Granby, 148, 183, 246, 323, 370, 434, *447, 542, 657, 683.
Granby Company's Methods of Mining and Smelting at Phoenix and Grand Forks, 113.*
Granby Consolidated, 739, 815.
Granby Consolidated Company, Annual Report of The, 27.
Granby Consolidated Mining Smelting and Power Co., 505.
Granby Consolidated Mining Smelting & Power Company, Annual Report, 707.*
Granby Copper Smelting Plants at Grand Forks and Anyox, B.C., by A. W. G. Wilson, 697.*
Granby Smelter, 478-479.*
Granby's Smelters, 693. E.
Graphite In Gold Ore From Kirkland Lake District, Ont., by J. A. Dawson, 578.
F. W. Gray, on A Mining Engineer of The Fifteenth Century, 256; on Hidden Coal Fields, 364; on Militarism vs. Patriotism, 633; on Oxygen Breathing Apparatus, 13: on The Coal Trade of Nova Scotia In 1913, 40; on The Colliers' March, 779; On the Present Status of Oxygen Breathing Apparatus, 154; on

The War and European Coal Fields, 695; on Trade Unionism and The War, 766.
Gray, F. W.'s translation of Dr. Forstmann's article on Oxygen Breathing Apparatus With and Without Injectors, 14.*
Guarding the Profession, 791.
Guess, G. A., 809.*
Guess, Geo. A., on Jacket Water, 363.

H

Hadfield, Sir Robert, on Manganese Steel Rails, 204.
Hailwood Lamps Pass Belgian Test, 96.
Hammer Drill vs. Reciprocating Drill, by P. B. McDonald, 417.*
Harricanaw, Special Correspondence, 30.
Hatch, F. H., on Relation of Geology to Mining, 373.
Haultain, H. E. T., On The Engineer, 793.
Hedley Gold Mining Co., 266.
Hedley Gold Mining Company's New Power System, 745.
Heinze, F. August, Taxation Case, 312.
Hidden Coal Fields, by F. W. Gray, 364.
Higgins Edwin, On Safety Movement In The Lake Superior Iron Regions, The, 774.
Hillcrest Collieries, 554.
Hillcrest Collieries, Ltd, 210.
Hillcrest Disaster, Report on, 768.
Hillcrest Disaster, The, 433. E.
Hillcrest Disaster, The, 503.*
Hillcrest Inquiry, 470.
Hillcrest Mine, 195 Lives Lost At, 444.*
Hingle, L. B., on A Brief Comparison of Methods and Conditions In The Witwatersrand and Lake Superior Districts, 481.*
History of Tunnelling, The, by D. W. Brunton and J. A. Davis, 611.
Hoch! Der Kaiser, 564.
Hoist Recently Installed At Beaver Mine, Cobalt, Ont, 352.*
Holland, Peat-Making Industry of Northern, 746.
Hollinger, 470. E.
Hollinger, 65, 220,* 295, 366, 471, 606, 750, 814.
Hollinger Gold Mines, 179.
Hollinger Gold Mines, Annual Report, 1913, 121.*
Hollinger Gold Mines Report, 110. E.
Hollinger Mine, The, 598. E.
Hollinger Mine, Gold Quartz Veins, 173.*
Hore, R. E., on Michigan Copper Deposits, 170.*
Hornblower, J. B. L., On Mining Costs, 388.
Hosmer Mine, The, 472.
Hudson Bay Exploring Expedition, 1912, by J. B. Tyrrell.
Hudson Bay Mining Co., 730.
Hudson Bay, Railway, 817.
Hughes, Ben., On Gold Mining at Porcupine and Kirkland Lake, Ont., 635.

I

Ice in Hudson's Bay, 718.
Igneous Contacts, Recrystallization of Limestones At, by C. K. Leith, 618.
Illinois, Longwall Mining In, 499.
Illinois Oil Fields, The, by H. A. Wheeler, 415.
Importance of Bore-Hole Records and Capping of Gas Wells, by W. J. Dick, 543.
Imports of Cyanide, 816.
In India, 654.
Increased Production at The Dome, 110.
Industrial Hysteria, 567.
Industrial Prosperity, The Relation of Big Business To, 387.
Influence of Nickel On Some Copper Alloys, The, by A. A. Read and R. H. Greaves, 258.
Intercolonial Coal Co., 204.
Intercolonial Railway, 751.
International Coal and Coke, 235.
International Engineering Congress, 1915, 126, 363, 765.
International Geological Congress, 727. E.
International Geological Congress, The, by H. Mortimer Lamb, 120.
International Geological Congress Excursions, 149, 179.*
International Nickel, 111, 536, 688.
International Nickel Co, The, 416.
Iron Industry, 361. E.
Iron Industry, The, 181. E.
Iron Industry, The. 293, 323.
Iron Ore Deposits, Bathurst Mines, New Brunswick, by G. A. Young, 339.
Iron Ore Deposits of Eastern and Western France, The, by Paul Nicon, 672.
Iron Ore In Michigan and Brazil, 4.
Iron Ore, Mining, 811.
Iron Ore, Mining, by E. S. Dickinson, 780.
Iron Ore Shipments, 404.
Iron Ore Surveys, Magnetic, 96.
Iron Ore Trade, The, 502. E.
Iron Ore Washing Plants, 376.*
Iron Ores, Electric Smelting of Canadian, by T. R. Loudon, 150.*
Iron Ores of Vancouver Island, 489.
Iron Ores, Titaniferous, 3.
Issue, The, 569.

J

Jacket Water, by Geo. A. Guess, 363.
Jacobs, E., on British Columbia In 1913, 46; on Coal Mining In British Columbia In 1913, 48; on Mine Rescue Training in B.C., 538.
Jennings, Hennen, on Mining As A Profession, 416.
Johnston, James, on The Mill and Metallurgical Practice of The Nipissing Mining Company, Limited, 205, 238; on Cyaniding Silver Ores at Nipissing Mine, Cobalt, 99.*
Johnston, R. A. A., on Radium And Its Ores, 305.
Jupiter, 220, 632.

K

Kalmus, H. L., on The Metal Cobalt And Its Alloys, 11.
Keeping Copper from the Enemy, 639.
Kerr Lake, 645.
Kerr Lake Discloses Rich Ore, The Drainage of, 472.*
Kerr Lake, Draining Of, 301.*
Kerr Lake Mining, 678.
Kerr Lake Mining Company, Anuual Report, 713.
Kerry, J. G. G., on Proposed T. & N. O. Ry. Extension to James Bay, 349.*
Kewagama, 819.
Kick's Law to the Measurement of Energy Consumed in Crushing, the Application Of, by S. J. Speak, 623.
Kiel Canal, The, 554.
Kirkland Lake, 139, 731.
Kirkland Lake & Swastika, 567.
Kirkland Lake District, Ont., Graphite in Gold Ore From, by J. A. Dawson, 578.
Kirkland Lake District, Ont., Microscopic Character of the Ore Deposits and Rocks of The, by Chas. Spearman, 329.*
Kirkland Lake Exploration, Limited, The, 236.
Kirkland Lake Flotations, 199.
Kirkland Lake, Ont., Gold Mining at Porcupine And, by Ben. Hughes, 635.
Kirkland Lake, Ont., Tough-Oakes Gold Mine, 259.
Kirkland Lake Ores, by E. G. Campbell, 631.
Kirkland Lake Porphyry, The, Correspondence, by Chas. Spearman, 362.
Kirkland Lake, Special Correspondence, 30, 66, 105, 142, 177, 212, 247, 286, *319, 358, 393, 431, 463, 497, 563, 592, 689, 723, 755, 785, 808.
Kitchener, 727.
Kitsaulte Copper Camp, Skeena, B.C., 616.
Klondike, Placer Mining In The, by D. D. Cairnes, 156.
Knapp, I. N., on Cementing Oil and Gas Wells, 405.*
Knighthood For A Chief Mine Inspector, 502.
Krupp Grusonwerk Ore Testing Plant, Magdeburg, Germany, 70.

L

Labor Organizations In Canada, 1913, 459.
Labor Troubles, Vancouver Island, 162.
Lake Superior District, 609.
Lake Superior Districts, A Brief Comparison of Methods And Conditions In The Witwatersrand And, by L. B. Hingle, 481.*
Lake Superior Iron Region, The Safety Movement In The, by Edwin Higgins, 774.
Lake Superior Mining Institute Annual Meeting, 605.
Lake Superior Standpoint, Pre-Cambrian Correlation from a, by C. K. Leith, 734. and 769.
Lamb, H. M., on The International Geological Congress, 120.
Large Increase in U. S. Zinc Exports, 815.
La Rose, 654, 752.
Late Minister of Colonization And Mines of The Province of Quebec, The, Hon. C. R. Devlin, 219.*
Laurier, Sir Wilfrid, 574.
Leckie, R. G.—Obituary, 136.
Leith, C. K., on Recrystallization of Limestones at Igneous Contacts, 618; on Pre-Cambrian Correlation from a Lake Superior Standpoint, 734, 769.
LeRoi No. 2, 338, 344.
LeRoy, O. E., on Rossland Ore Deposits, 386.
Liege, 559.
Lifting and Shifting Machinery, 591.
Lillooet District, B. C., 344.
Limestones at Igneous Contacts, Recrystallization of, by C. K. Leith, 618.
Liquor Regulations, 501. E.
Liston, John, on Electricity In Coal Mines, 640.*
Lock Gate Lifter Trent Canal, 659.*
Lode Mining in Yukon, 663.
Lode Mining in Yukon Territory, 553.
Lodge, Mathew, on Gas and Oil Fields of New Brunswick, 201.*
Loewenstein, Louis C, on Centrifugal Compressors, 679.
Longwall Machine Mining, by J. F. K. Brown, 435.
Longwall Mining in Illinois, 499.
Lorraine Iron Deposits, 630. E.
Loudon, T. R., on Electric Smelting of Canadian Iron Ores, 150.*
Lyons, H. M., on Electrical Driving of Winding Engines And Rolling Mills, The, 223, 265.*

M

Maclaren, Malcolm, on The Persistence of Gold Ore In Depth, 88.
Magnesite, 772.
Magnetic Iron Ore Surveys, 96.
Magnetite Ore Deposits, Ontario, 318.
Malloch, Geo. S., Dead, 627.
Manganese, 621.
Manganese Ore from Russsia and Brazil, 683.
Manganese Steel, by W. S. Potter, 153.
Manganese Steel Rails, by Sir Robert Hadfield, 204.
Manufacture of Coke In the U. S., The, 657.
Many Men are Needed, 634.
Map of White River and Chisana Districts, 318.

Maritime Provinces, Building and Ornamental Stones Of The, 541.
Markets, 36, 72, 108, 144, 180, 216, 252, 288, 324, 360, 396, 432, 468, 500, 532, 564, 596, 628, 660, 692, 724, 756, 788, 820.
Marquette Iron Range, 678.
Massey Copper Mine Area, The, by A. P. Coleman, 378.
McDonald, P. B., on Modern Rock Drills, 343; on Hammer Drills vs. Reciprocating Drills, 417.*
McGill Graduates and the War Situation, 609.
McGillivray Creek Coal & Coke Co., Ltd, 553.
McIntyre, 472, 624, 731.
McKinley Darragh, 229.
McKinley-Darragh-Savage, 683.
Means, C. M., on the Safety of Underground Electrical Installations, 620.
Megraw, Herbert A., on The Use of Compressed Air In Cyanidation, 92.
Metal Cobalt and its Alloys, The, by H. T. Kalmus, 11.
Metal Mines And Smelters In Canada, 137.
Metal Output of Ontario, 819.
Metal Prices Advance, 564.
Metal Products and Imports, 696.
Metallurgical Practice of The Nipissing Mining Company, Limited, The Mill And, by James Johnston, 205, 238.*
Methods of Mining And Smelting At Phoenix And Grand Forks, Granby Company's, 113.*
Methods of Working A Thin Coal Seam At Joggins, N.S., by C. H. McL. Burns, 537.*
Mexican Petroleum, 530.
Mica, 112, 148.
Michigan And Brazil, Iron Ore In, 4.
Michigan Copper Deposits, by R. E. Hore, 170.*
Michigan Mine Workers, Wages Of, 274.
Michigan Silver, 818.
Michigan, Western Federation Strike In, 55.*
Michigan, Western Federation Calls Off Strike In, 312.
Mickle, G. R., on Composition of Natural Gas, The, 740.
Microscopic Character of The Ore Deposits And Rocks of The Kirkland Lake District, Ont., by Chas. Spearman, 329.*
Microscopic Tests on Opaque Minerals, by Everend L. Bruce, 748.
Mid-Continent Field, The Occurrence of Petroleum and Natural Gas in the, by Chas N. Gould, 485.
Militarism vs. Patriotism, by F. W. Gray, 633.
Mill and Metallurgical Practice of the Nip. Mining Co., Ltd., Cobalt, Ont., The, 588.
Mill And Metallurgical Practice of The Nipissing Mining Co., Ltd., Cobalt, Ont., The, by G. H. Clevenger, 555.
Mill and Metallurgical Practice of The Nipissing Mining Company, Limited, The, by James Johnston, 205, 238.*
Millie Mack, 434.
Mine Accidents In British Columbia, 362.
Mine Rescue Training In B. C., by E. Jacobs, 538.
Mine Sanitation, 50.
Miner As A Pioneer, The, by T. A. Rickard, 457.
Mineral Exhibit, 591.
Mineral Exhibits at Panama-Pacific Exposition, 765.
Mineral Industry of the Province of Quebec, 1913 by Theo. C. Denis, 44.
Mineral Production of Canada In The Year 1913, 182. E.
Mineral Production of Canada During the Year 1913, The, 189.
Mineral Production of Ontario, 1913, by T. W. Gibson, 196.
Mineral Production of Ontario, 1913, 251.
Mineral Production of Quebec In 1913, by T. C. Denis, 265.
Mineral Resources of Alberta, 503. E.
Minerals Separation Decision, The, 340.
Mining Accidents, 326. E.
Mining Accidents In Ontario, 253. E.
Mining Accidents In Ontario, 347.
Mining As A Profession, by Hennen Jennings, 416.
Mining Congress Discussion, 812.
Mining Corporation of Canada, The, 817.
Mining Costs, by J. B. L. Hornblower, 388.
Mining Engineer of The Fifteenth Century, A, by F. W. Gray, 256.
Mining Gold Ore At The Dome Mine, 75.*
Mining In British Columbia, 604.
Mining In Ontario In 1913, 39.
Mining Industry In Relation to the Temiskaming And Northern Ontario Railway, The, by A. A. Cole, 294.
Mining Investments, 381.
Mining Iron Ore, 811.
Mining Iron Ore, by E. S. Dickinson, 780.
Mining Law Revision, 434.
Mining Men and The War, 565. E.
Mining Men At the Front, 811.
Mining Operations In Quebec, 1913, 541.
Mining Society of Nova Scotia, The, by F. H. Sexton, 337.
Mining Society of Nova Scotia, The, 671.
Mining Society of Nova Scotia, The Twenty-Second Annual Meeting of The, 291.
Mining Unions At Butte, The, 590.
Modern Rock Drills, by P. B. McDonald, 343.
Modern Rock Drill, The, by W. L. Saunders, 25.
Mond Nickel, 816.
Mond Nickel Co., 448.
Mond Nickel Company's Smelting Plants, At Victoria Mines and Coniston, Ont., by A. W. G. Wilson, 667.*
Mond Process of Separating Nickel And Copper, The, 306.*
Monell Method of Separating Nickel and Copper Sulphides, 85.
Montreal Mining Exchange, 806.
Moore, E. S., on A Visit To Some Pacific Coast Mines, 5.*
Mother Lode and Sunset Mines, 607.
Motor Spirits, 418.
Mount Royal Tunnel, Canadian Northern Railway, by D. J. O'Rourke, 128.*
Mr. A. A. Cole's Report, 362. E.
Mr. D. A. Thomas' Projects, 424.
Mt. Robson, 221.*
Mud-Laden Fluid Applied to Well-Drilling, 454.
Munro Township, Special Correspondence, 247, 358.
Museum Bulletin, 567.

N

Natural Gas, Composition Of, The, by G. R. Mickle, 740.
Natural Gas in the Mid-Continent Field, The Occurrence of Petroleum And, by Chas. N. Gould, 485.
Natural Resources of Canada, by F. D. Adams, 419.
Natural Resources of Peace River Country, 773.
Negannee Mine, Storage and Measuring Pockets At, by S. R. Elliott, 22.
Nettell, A. J. Colclough, on The Treatment of Zinc Ores, 94.
New Brunswick, Gas And Oil Fields Of, by Mathew Lodge, 201.*
New Hoist For Beaver Mine, 175.
New Maps, 723.
New Morris Crane, A, 691.
New Provisions of Petroleum and Gas Regulations, 148.
Nickel and Copper Sulphides, Monell Method of Separating, 85.
Nickel and Copper, The Mond Process of Separating, 306.*
Nickel Deposits of New Caledonia, 759. E.
Nickel Industry, The, 661. E.
Nickel Question, The, 789. E.
Nickel, Separation of Copper From, 801.
Nicon, Paul, on The Iron Ore Deposits of Eastern and Western France, 672.
Ninety Pound Drilling Machine In Michigan, 492.
Nipissing, 111, 135, 174, 237, 615, 659.
Nipissing Mine, Cobalt, Cyaniding Silver Ores At, by Jas. Johnston, 99.*
Nipissing Mines Co., 683.
Nipissing Mines Co., 1913, Annual Report of, 295.*
Nipissing Mining Co., Ltd., Cobalt, Ont., The Mill and Metallurgical Practice of The, 588.
Nipissing Mining Co., Ltd., Cobalt, Ont., The Mill and Metallurgical Practice of The, by G. H. Clevenger, 555.
Nipissing Mining Company, Limited, The Mill and Metallurgical Practice of The, by James Johnston, 205, 238.*
Nomenclature Of Alloys, 558.
North Thompson and Porcupine Crown, 681.
Northern Ontario Gold and Silver Mining In, 298.*
Not As Expected, 615.
Notes On Mining In West Kootenay And Boundary Districts of British Columbia, 478.
Nova Scotia Coal Production In 1914, 791. E.
Nova Scotia In 1913, The Coal Trade Of, by F. W. Gray, 40.
Nova Scotia Mining Industry, In 1913, Progress In, by F. H. Sexton, 371.
Nova Scotia, Special Correspondence, 426, *465, 496, 527, 593, 656, 722.
Nova Scotia Steel, 718.
Nova Scotia Steel Co., 751.
Nova Scotia Steel & Coal Co., 155.
Nova Scotia, The Mining Society Of, by F. H. Sexton, 337.

O

Obituary—R. G. Leckie, 136; James D. Sword, 137; Duncan Irvine, 246; James Morrish, 280; Thomas Starbird, 317; Arthur A. Austin, 524; A. B. Willmott, 356; A. E. Barlow, 398; George Turner, 494; Edward Leigh Goodwin, 624; Henry Bratnober, 654; George Turner, 494; W. J. Sutton, 391; Mrs. D. D. Cairnes, 783; J. F. C. Fraser, 783; Randall Hichcock Kemp, 783; Hon. Wm. Templeman, 784; Wm. McGarvey, 807.
Observation of Mining Regulations, The, 325. E.
Occurrence of Gold in Ontario, The, by J. B. Tyrrell, 230.
Occurrence of Petroleum And Natural Gas In The Mid-Continent Field, The, by Chas. N. Gould, 485.
Oil and Gas Field, New Brunswick, Stony Creek, by G. A. Young, 453.
Oil Company Promotions, 534. E.
Oil Discovered At Great Depth In Alberta, 370.
Oil Drillers Busy, 372.
Oil Fields, Canadian, 364.
Oil Fields of Europe, 631.
Oil Fields of New Brunswick, Gas And, by Mathew Lodge, 201.*
Oil Fields, The Illinois, by H. A. Wheeler, 415.
Oil Pumping In California, 522.
Omineca River District—British Columbia, 255.
One Task For All, 599.
Ontario In 1913, Mining In, 39.
Ontario Magnetite Ore Deposits, 318.

Ontario's Mineral Production for Half Year, 615.
Ontario Mineral Production In First Quarter of 1914, 458.
Ontario Mines in 1913, 725. E.
Ontario, Mining Accidents In, 347.
Ontario's New Premier, 661. E.
Ontario's Silver Output, 433. E.
Opaque Minerals, Microscopic Tests On, by Everend L. Bruce, 748.
Opening A Coal Mine In Nova Scotia, by C. M. Odell, 441.
Opening of The Panama Canal, 639.
Ore and Fuel Testing Plants, 28.
Ore Deposits of Atlin District, by D. D. Cairnes, 449.
Ore Deposits of The Similkameen District, B. C., by Chas. Camsell, 309.*
Ore Dressing, Percentage Recovery In, by Edgar P. Anderson, 97.
Ore Shipments From Cobalt Silver District In 1913, 98.
Ore Testing Plant, Magdeburg, Germany, Krupp Grunonwerk, 70.*
Origin of Coal, The, 658.
Origin of Petroleum, The, by Dr. Hans Von Hofer, 413.
Origin of the Rocky Mountains, 760.
O'Rourke, D. J., on Canadian Northern Railway Mount Royal Tunnel, 128.*
Oxygen Breathing Apparatus, 2. E.
Oxygen Breathing Apparatus, by F. W. Gray, 13.
Oxygen Breathing Apparatus With And Without Injectors, by Dr. Ing. Forstmann, translated by F. W. Gray, 14.*

P

Pacific Coast Mines, A Visit to Some, by E. S. Moore, 5.*
Painkiller Lake, 323.
Panama Canal, Opening of The, 639.
Panama-Pacific Exposition, Canadian Building At, 137.
Panama-Pacific Exposition Mineral Exhibits At, 765.
Panama-Pacific International Exposition, Canadian Mining Exhibit at the, 398.
Peaceful Germans and Austrians Are Safe, 599.
Peace River Country Natural Resources Of, 773.
Peat, 98.
Peat, Commercial Uses For, by Arthur J. Forward, 743.
Peat-Making Industry of Northern Holland, 746.
Pennsylvania Anthracite, 60.
Percentage Recovery In Ore Dressing, by Edgar P. Anderson, 97.
Persistence of Gold Ore In Depth, The, by Malcolm Maclaren, 88.
Personal and General, 28, 64, 102, 139, 175, 211, 246, 279, 316, 355, 391, 425, 462, 493, 523, 559, 592, 624, 653, 688, 719, 752, 783, 807.
Peterson Lake, 111, 364, 554.
Peterson Lake Annual Report, 369.
Petroleum, 71.
Petroleum And Natural Gas In The Mid-Continent Field, The Occurrence Of, by Chas. N. Gould, 485.
Petroleum Emanations vs. the Anticlinal or Structural Theory of Petroleum Accumulations, Rock Disturbances, Theory of, by Eugene Coste, 647.
Petroleum, Mexican, 530.
Petroleum, The Origin Of, by Dr. Hans Von Hofer, 413.
Petroleum, The Volcanic Origin Of, by Dr. Hans Von Hofer and Eugene Coste, 473.
Picking Table Screen, A, 624.
Placer Mining In The Klondike, by D. D. Cairnes, 156.
Porcupine, 254. E.
Porcupine, 404.
Porcupine and Cobalt, 2. E.
Porcupine and Kirkland Lake, Ont, Gold Mining at, by Ben Hughes, 635.*
Porcupine Crown, 167, 772.
Porcupine Crown and North Thompson, 681.
Porcupine Crown Mill and Cyanide Plant, 303.*
Porcupine, Special Correspondence, 30, 66, 105, 142, *177, 212, *247, 286, 319, 358, 393, 431, 463, 497, 527, *563, 592, 689, 723, 755, 785, 808.
Porcupine Vipond, 811.
Porcupine, Vipond Mines, 636.*
Porcupine Vipond Mines, Ltd, 352.
Porcupine Three Nations, 167.
Portable Motor Operated Compressor, 653.*
Portable Sub-Station For A Coal Mine, A, 34.*
Potash Situation In U. S., The, 762.
Potter, W. S., on Manganese Steel, 153.
Power Equipment for Windsor Hotel, 35.
Pre-Cambrian Correlation From A Lake Superior Standpoint, by C. K. Leith, 734 and 769.
Pre-Cambrian Geology of South-Eastern Ontario, The, 541.
Present Status of Oxygen Breathing Apparatus, The, by F. W. Gray, 154.
Pretoria Mint to be Re-Opened, 626.
Prevention of Mining Accidents, 591.
Professional Ethics, by Dr. Rossiter W. Raymond, 506.
Professor Richards Of Tech. Retires, 461.
Progress In Calgary Oil Field, 606.
Progress In Nova Scotia Mining Industry In 1913, by F. H. Sexton, 371
Proposed General Strike In British Columbia, 545.
Proposed T. & N. O. Ry. Extension to James Bay, by J. G. G. Kerry, 349.*
Prospectors Hand Book, A, 534.

Q

Quebec, 1913, Mineral Industry of the Province Of, by Theo. C. Denis, 44.
Quebec In 1913, Mineral Production Of, by T. C. Denis, 265.
Quebec, Special Correspondence, 67, 393.
Quick Acting Coupling For Mine Service, A, 111.
Quincy Mining Company, Rock-House Practice of the, by T. C. DeSollar, 51.*

R

Radium And Its Ores, by R. A. A. Johnston, 305.
Radium In Ontario Reward For Discovery Of, 293.
Radium Production of U. S., 645.
Railways And Mineral Production, 221.
Railways And Mining, 289. E.
Rainy Lake, The Archean Geology Of, 654.
Rembler-Cariboo Mines, Limited, 480.
Rand, Business As Usual On The, 664.
Ray and Nevada, 626.
Raymond, R. W., on Comparison of Mining Conditions In the United States To-Day With Those of 1872, 159; on Professional Ethics, 506.
Rea Mine, 626.
Recent Publications of The Geological Survey, Canada, 245.
Reclaiming Calumet and Hecla Tailings With A Hydraulic Dredge, 729.*
Recovery of Silver From Cobalt Ores, The 74. E.
Recrystallization of Limestones at Igneous Contacts, by C. K. Leith, 618.
Refining Nickel In Canada, 790. E.
Refining Nickel Matte, 662. E.
Regrinding Plant, Calumet and Hecla, 365-366.*
Relation of Big Business To Industrial Prosperity, 389.
Relation of Geology To Mining, by F. H. Hatch, 373.
Report On Hillcrest Disaster, 768.
Resuscitation, From Mine Gases and Shock, 652.
Reward For Discovery of Radium In Ontario, 293.
Rheims, 742.
Rhymes of the Re-Survey, The, by R. Sydney Bartram, 800.
Richard, T. A., on The Miner As A Pioneer, 457.
Right of Way, 751.
Riot Cases, Vancouver Island, 264.
Rock Disturbances Theory of Petroleum Emanations vs. the Anticlinal or Structural Theory of Petroleum Accumulations, by Eugene Coste, 647.
Rock Drill, The Modern, by W. L. Saunders, 25.
Rock Drills, by W. L. Saunders, 86.
Rock House At No. 3 Mine, Canadian Copper Co., 382.*
Rock-House Practice of the Quincy Mining Company, by T. C. DeSollar, 551.*
Rocky Mountains Branch, Canadian Mining Institute, 188.
Rossland Ore Deposits, by O. E. LeRoy, 386.
Routes to Moose Factory, The, 471.
Russian Asbestos, 370.
Ryerson, Colouel G. Sterling, Canadian Contribution to the Medical Service in the Great European War, 733.

S

Safety And Efficiency In Mine Tunnelling, 521.
Safety Movement In the Lake Superior Iron Region, The, by Edwin Higgins, 774.
Safety of Underground Electrical Installations, The, by C. M. Means, 620.
Salt, 148.
Salt Mine, Westinghouse Motor Does Good Service In A, 107.
Saunders, W. L., on The Modern Rock Drill, 25; on Rock Drills, 86.
Schumacher, 632.
Schwab's Visit to Moutreal, Mr., 816.
Scotland, Shale Oil Industry Of, 782.
Selling Silver, 695. E.
Seneca Superior Mine, 248.
Separating Nickel and Copper Sulphides, Monell Method Of, 85.
Separation of Copper from Nickel, 801.
Sesekinaka, 510.
Sesekinaka, Special Correspondence, 592, 563.
Settlement of Colorado Strike, 659.
Sexton, F. H., on Progress In Nova Scotia Mining Industry, In 1913, 371; on The Mining Society of Nova Scotia, 337.
Shale Oil Industry of Scotland, 782.
Sheep River Gas And Oil Field, Alberta, by D. B. Dowling, 399.*
Shields & Thielmann Jig, The, 367.*
Shushanna Mining and Trading Company, 107.
Silver Deposits, Gowganda, by W. H. Collins, 168.
Silver for Coinage, 597. E.
Silver Hoard Mine, Ainsworth, B.C., 467.
Silver Industry, The, 566.E.
Silver Mining, 597. E.
Silver Mining In Northern Ontario, Gold and, 298.*
Silver Ores At Nipissing Mine, Cobalt, Cyaniding, by Jas. Johnston, 99.*
Silver Ores, Smelting The Cobalt, by A. A. Cole, 20.
Silver Prices, 36, 72, 108, 144, 180, 216, 252, 288, 324, 360, 396, 432, 468, 500, 532, 596, 628, 660, 692, 724, 756, 788, 820.
Similkameen District, B.C., Ore Deposits of The, by Chas. Camsell, 309.*
Sinking Shafts In Wet Ground, 146. E.

Sixth International Congress, 404.
Slide Rule Improvement, 471.
Slocan, 372.
Slocan Star Mines, Ltd., 3.
Smelting At Phoenix and Grand Forks, Granby Company's Methods of Mining And, 113.*
Smelting Furnace For Cyanide Precipitate, 440.
Smelting Michigan Copper Ores, 511.*
Smelting The Cobalt Silver Ores, by A. A. Cole, 20.
Smith, E. A. Cappelen, on Copper Leaching And Electrolytic Precipitation At Chuquicamata, Chile, 431.
Solidification of Metals, The, 536.
Some Members of the Steffanson Expedition, 646.
South Lorrain, Special Correspondence, 106, 212, 358, 394, 430, 463, 527, 562, 592, 689, 722, 754, 785.
Speak S. J., on The Application of Kick's Law to the Measurement of Energy Consumed In Crushing, 623.
Spearman, Chas., on Microscopic Characters of The Ore Deposits And Rocks of The Kirkland Lake District, Ont., 329*; on The Kirkland Lake Porphyry, Correspondence, 362.*
Speeches of Sir Robert Borden and Sir Wilfrid Laurier in Parliament, Wed., Aug. 19, 1914, The, 574.*
Spelter, 818.
Stadia Circle, A New, 491.
Stamps, The Weight of Rand, 342.
Standard Oil, 414.
Standard Silver Lead Mining Co., 235.
Steel Company of Canada, 246.
Steel Making for Electric Furnace, The, by Walter N. Craft, 717.
Steel Orders Renewed, 634.
Sheet Plant Erection, 617.
Steel Production For, 1913, 215.
Steel, The Electrometallurgy Of, 244.
Steffanson Expedition, Some Members of The, 646.
Stirling, John T, on Coal Mining in Alberta In 1913, 763.
Stock Markets, 36, 72, 108, 144, 180, 216, 252, 288, 324, 360, 396, 432, 468, 500, 532, 596, 628, 660, 692, 724, 756, 788, 820.
Stony Creek Oil and Gas Field, New Brunswick, by G. A. Young, 453.
Storage And Measuring Pockets At Negaunee Mine, by S. R. Elliott, 22.*
Strike In British Columbia, Proposed General, 545.
Strike In Michigan, Western Federation, 55.*
Strike In Michigan, Western Federation Calls Off, 312.
Successful Method of Amalgamating in Cyanide Solution A, 300.*
Successful Treatment of Zinc Sulphide Ores, The, by Frank L. Wilson, 127.
Sullivan Angle-Compound Air Compressors, 32.
Summary Report of the Geological Survey For 1912, 490.
Supervision of Coal Mining, 521.
Surf Inlet Gold Mine, Princess Royal Island, B.C., 379.
Sutton, W. J., Obituary, 391.
Swastika, Special Correspondence, 66, 177, 212, 286, 319, 393, 497, 527, 689, 723, 755.
Sword, James D., Obituary, 137.
Systematic Timbering in Coal Mines, 198.

T

T. & N. O. Ry. Extension to James Bay, Proposed, by J. G. G. Kerry, 349.*
Tar Forming Temperatures of American Coals, 521.
Technical Education In Nova Scotia, 424.
Taxation Case, F. August Heinze, 312.
Technical Education In Nova Scotia, 398. E.
Teck-Hughes, 812
Temiskaming And Northern Ontario Railway, The Mining Industry In Relation To The, by A. A. Cole, 294.
Temiskaming Mining Co., 716.
Testing Old Shales, 621.
The Day, by Henry Chappell, 632.
Thirteen-Cent Copper, 803.
Timiskaming, 183.
Titaniferous Iron Ores, 3.
To Investigate Labor Conditions, 664.
To Merge Cobalt Properties, 199.
Toronto Union Station, 531.
Tough Oakes, 183, 395.
Tough-Oakes Gold Mine, Kirkland Lake, Ont., 259.*
Trade Unionism and The War, by F. W. Gray, 766.
Trading in Mining Stocks, 566. E.
Trail Smelter Ore, 817.
Training of Mining Geologists In Great Britain, The, 366.
Treatment of British Columbia Zinc Ores, 333.
Treatment of Gold Ore At The Dome Mine, 73. E.
Treatment of Gold Ore At Dome Mine, South Porcupine, Ontario, The, by D. L. H. Forbes, 77.
Treatment of Zinc Ores, The, by A. J. C. Nettell, 94.
Tubular Steel Tripod, A, 691.
Tungsten, 63.
Tunnel Accidents, Causes And Prevention Of, by D. W. Brunton and J. A. Davis, 513, 546.
Turbine Pumps, 460.*
Turner, George, Obituary, 494.
Twenty-Second Annual Meeting of the Mining Society of Nova Scotia, The, 291.
Tyrrell, J. B., on The Occurrence of Gold In Ontario, 230; on Hudson Bay Exploring Expedition, 1912, 61.

U

Underground Electrical Installations, Safety of The, by C. M. Means, 620.
Underground Transportation, 745.
Unit Constructions Costs, 534. E.
United States Brass Industry, The, 536.
United States Bureau of Mines, Beneficial Results of the Work of, The, 804.
United States, Coal Mine Accidents In The, 28.
U. S. Copper Shippers Protest, 751.
U. S. Iron & Steel Trade, 683.
U. S. Radium Production, 645.
Use of Compressed Air In Cyanidation, The, by Herbert A. Megraw, 92.
Use of Mud In Well Drilling, 815.

V

Vancouver Chamber of Mines, 120.
Vancouver Island Labor Troubles, 162.
Vancouver Island Riots, The, 254. E.
Vancouver Island Riot Cases, 264.
Van-Roi Mining Co., Ltd., Annual Report Of, 345.
Venezuela Ore, 287.
Vertical Range Of Metals Deposited by Secondary Processes, The, by Wm. Harvey Emmons, 383.
Vipond, 522.
Vipond Gold Mine, 627.
Visit to Some Pacific Coast Mines, A, by E. S. Moore, 5.*
Volcanic Origin Of Petroleum, The, by Dr. Hans Von Hofer and Eugene Coste, 473.
Von Hofer, Dr. Hans, on The Origin of Petroleum, 413; on The Volcanic Origin of Petroleum, 473.

W

Wages of Michigan Mine Workers, 274.
Wagon Loader, A, 461.*
War and European Coalfields, The, by F. W. Gray, 695.
War and its Effects on Mining, The, 533. E.
War and Oil, 630.
War, The Canadian Contribution to the Medical Service In the Great European, by Colonel G. Sterling Ryerson, 733.
War, Trade Unionism and The, by F. W. Gray, 766.
Washing Oil Wells, 434.
Weekly Pay, 254. E.
Weight of Rand Stamps, The, 342.
Welland Canal Construction, 818.
Well-Drilling, Mud-Laden Fluid Applied, To, 454.
West Shining Tree, 503.
Western Branch, C. M. I., 65, 187, 446.
Western Federation Calls Off Strike In Michigan, 312.
Western Federation Methods, 37. E.
Western Federation Strike Declared Off, 290. E.
Western Federation Strike in Michigan, 55.*
Western Natural Gas Co., 626.
Western Railway Rates, 315.
Westinghouse Motor Gives Good Service In A Salt Mine, 107.
Wheaton District, Yukon, 443.
Wheeler, H. A., on The Illinois Oil Fields, 415.
Will Investigate Iron Mining Industry, 666.
Will Oil Replace Coal as Fuel? 510.
Willcocks, A., on Centrifugal Compressors, 760.
Wilson, A. W. G., on Granby Copper Smelting Plants at Grand Forks and Anyox, B.C., 697*; on Mond Nickel Company's Smelting Plants at Victoria Mines and Coniston, Ont., 667.
Wilson, Frank L., on The Successful Treatment of Zinc Sulphide Ores, 127.
Windsor Hotel, Power Equipment For, 35.
Witwatersrand & Lake Superior Districts, A Brief Comparison of Methods and Conditions In The, by L. B. Hingle, 481.*
Word In Season, A, 568.
Workman's Compensation Committee, 819.
Workman's Compensation In Ontario, 772.

Y

"Yardage" Dispute At Coal Creek and Michel, 31.
Ye Mariners of England, 535.
Year 1913, The, 1. E.
Young, G. A., on Iron Ore Deposits, Bathurst Mines, New Brunswick, 339; on Stony Creek Oil and Gas Field, New Brunswick, 453.*
Yukon, 318.
Yukon Frozen Up, 773
Yukon Gold, 183, 246.
Yukon, Lode Mining In, 663.
Yukon, Special Correspondence, 68.
Yukon Territory, 287.
Yukon Territory, Lode Mining In, 553.

Z

Zinc Exports, Large Increase In U. S., 815
Zinc Ores, The Treatment of, by A. J. C. Nettell, 94.
Zinc Ores, Treatment of British Columbia, 333.
Zinc Sulphide Ores, The Successful Treatment Of, by Frank L. Wilson, 127.

JANUARY 1, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

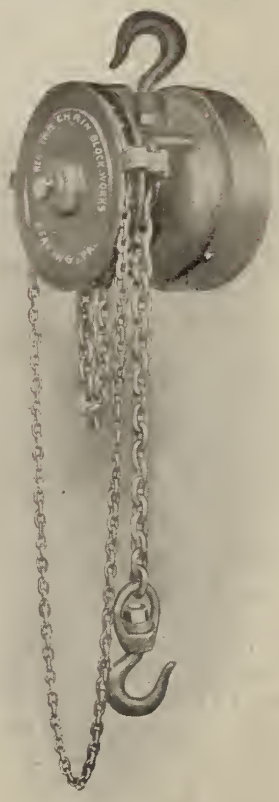
VOL. XXXV TORONTO No. 1

THEY NEVER WEAR OUT

Reading Multiple Gear Chain Hoists

are put together as carefully as a watch, with every detail for Hard Service considered.

Guaranteed to be weatherproof.



WORKING PARTS are protected by OIL-TIGHT, DUST-PROOF CASES, which hold oil sufficient for six months lubrication.

Work in any position.

Try a **READING** in comparison with ANY BLOCK and watch RESULTS.

CARRIED IN STOCK

MUSSENS LIMITED

MONTREAL, 318 St. James St. TORONTO, 155 West Richmond St. COBALT, Opp. Right of Way Mine WINNIPEG, 259-261 Stanley St. CALGARY, 10th Ave. and 3rd St. E.

VANCOUVER 318 Richards St. QUEBEC 31 St. Louis St. ST. JOHN, N.B. 57 Symthe St. HALIFAX 78 Granville St.

THE JOURNAL OF COMMERCE WITH WHICH IS INCORPORATED The Shareholder

TWO of the oldest and most reliable Weekly Journals, recently amalgamated to strengthen the work heretofore done by each in the field of Commerce, Finance, Insurance and Industry. Editor, *J. C. Ross, M.A.*

Canada's greatest asset is her natural resources and the commodities by which she is best known are the products of industries engaged in the development of these resources. Canadian **ASBESTOS, NICKEL** and **COBALT** control the Markets of the world for these commodities, while her **SILVER, PULP** and **PAPER,** and **GRAIN** and **GRAIN PRODUCTS** are dominant factors of the world's supplies. The only Periodicals which are devoted entirely to these industries are :

CANADIAN MINING JOURNAL, published twice a month. Editor, *Reginald E. Hore, M.Sc.*

PULP AND PAPER MAGAZINE OF CANADA, published twice a month. Editor, *A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST, published once a month. Editor, *J. G. Adams, B.A.*

CANADIAN TEXTILE JOURNAL, a monthly periodical devoted entirely to Textile Manufacturing, is published from the same Offices. Editor, *E. Stanley Bates.*

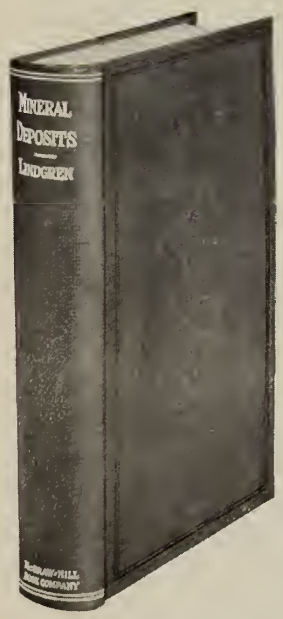
In addition to publishing the above mentioned Journals, we are especially equipped to do all kinds of

FINE BOOK, CATALOGUE AND JOB PRINTING

MONTREAL OFFICE
Industrial and Educational Press, Limited
Read Building

TORONTO OFFICE:
Industrial and Technical Press, Limited
44-46 Lombard St.

Lindgren— MINERAL DEPOSITS



For Sale by the

Canadian Mining Journal

44-46 Lombard St. Toronto

By WALDEMAR LINDGREN, Professor of Economic Geology, in in charge of the Department of Geology, Massachusetts Institute of Technology ; Geologist, United States Geological Survey.

883 *pages, 6x9, 257 illustrations,* $5.00 (21s) *net, postpaid*

For many years Mr. Lindgren has been Geologist of the United States. Geological Survey.

In this time he has come to be generally recognized as the leading authority on ore deposits.

The publication of this work on "Mineral Deposits" has been anticipated throughout the world.

It is the first book to attempt to cover within reasonable space both metallic and non-metallic minerals, except coal and oil.

—CONTENTS—

Introduction.
Deposition of Minerals.
The Flow of Underground Waters.
The Composition of Underground Waters.
The Chemical Work of Underground Waters.
The Origin of Underground Water and its Dissolved Substances.
The Spring Deposits at the Surface.
Relations of Mineral Deposits to Mineral Springs.
Folding and Faulting.
Openings in Rocks.
Form, Structure and Texture of Mineral Deposits.
Ore Shoots.
Classification of Mineral Deposits.
Deposits Formed by Mechanical Processes of Transportation and Concentration ; Detrital Deposits.
Deposits Formed by Chemical Processes of Concentration in Bodies of Surface Waters.
Deposits Formed by Evaporation of Bodies of Surface Waters.
Deposits Formed by Processes of Rock Decay and Weathering.
Deposits Formed by Concentration of Substances Contained in the Surrounding Rocks by Means of Circulating Waters.
Deposits Formed by Regional Metamorphism Formed by Zeditisation.
Deposits of Native Copper in Basic Lavas.
Lead and Zinc Deposits in Sedimentary Rocks in their Genetic Connection with Igneous Rocks.
Deposits Formed Near the Surface by Ascending Thermal Waters and in Genetic Connection with Igneous Rocks.
Deposits Formed at Intermediate Depths by Ascending Thermal Waters and in Genetic Connection with Intrusive Rocks.
Veins and Replacement Deposits Formed by Hot Ascending Waters at High Temperature and Pressure and in Genetic Connection with Intrusive Rocks.
Deposits Formed by Processes of Igneous Metamorphism.
Mineral Deposits of Pegmatite Dikes.
Mineral Deposits Formed by Concentration in Molted Magmas.
Metamorphosed Deposits.
Oxidation of Metallic Ores.
Calculation of Analysis and Representation by Diagrams

WE SPECIALIZE IN

KENNEDY ROCK CRUSHING PLANTS

Cement Plants

Mine and Milling Plants

Oil Well Drills Locomotive Cranes

Concrete Mixers

Rock, Gravel and Sand Handling Machinery

Rock & Power Machinery

Limited

P. H. MOORE - - General Manager

Late Manager Mining, Crushing and Cement Machinery
Dept. for Canadian Allis-Chalmers Limited.

HEAD OFFICE :

Royal Bank Bldg., 12 King St. East, Toronto

BRANCH OFFICES :

KING EDWARD HOTEL, TORONTO ; VANCOUVER ; CALGARY ;
WINNIPEG ; SUDBURY ; MONTREAL ; OTTAWA ;
COBALT ; HALIFAX.

Imperial Bank
of Canada

Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Paid Up	6,925,000
Reserve and Undivided Profits	8,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

SAFE MINERS' SAFETY LAMPS

with Hailwood's Patent Impregnable Magnetic Lock

Manufactured by the Worlds' Safety Lamp Experts

ACKROYD & BEST, LTD.,
Morley, Leeds, England

Specialists in Miner's Lamps and Equipment for same; Hailwood's Patent Fool-proof, Flame-proof, Underground Relighting Machines; Lamproom Lighting and Unlocking Machines; Cleaning Machines; Filling Machines; Iron Lampstands; Cleaning Benches, etc., etc. For full particulars apply:

Ackroyd & Best, Ltd.
No. 2 Arrott Power Buildings, Barker Place,
Pittsburg, Pa., U.S.A.
Telephone Nos. P. & A. Tel. Main 2217, Bell " Grant 1619

UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

For Calendar and other information apply to the Secretary,

A. T. LAING

Continuous Coal Cutter near Edmonton, Alberta, 54° North

Continuous Coal Cutter in Australia, 30° South

Farthest North and Farthest South

From Spitzbergen, in the Arctic Circle, to Victoria, Australia, 40 degrees below the equator, and thickly sprinkled in between, you will find

Sullivan Ironclad Coal Cutters

mining the world's coal supply most economically, wherever modern methods are in vogue.

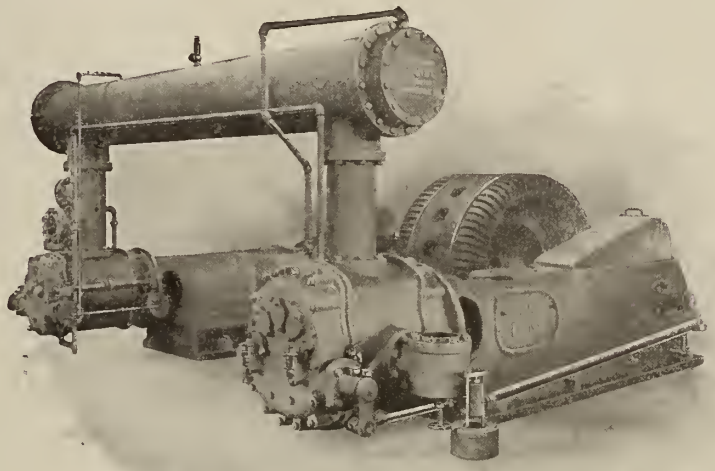
Bulletin 663 H.

Fans, Air Compressors, Diamond Core Drills, Rock Drills, Pick Machines, Car Dumps.

Sullivan Machinery Company

122 South Michigan Ave.
CHICAGO

HOW MUCH WASTED POWER ARE YOU PAYING FOR?



INGERSOLL-RAND
Class "RE-2"
Compressor with Motor mounted directly on shaft.

Theoretically, it is possible to know in advance just how much power will be needed to produce a given volume of air at a given pressure. Actually, the air-compressor indicator card may show a sad discrepancy from anticipations.

Summed up, the story told by this card is a story of wasted power, paid for but never delivered in useful energy. What sort of a story does your air card tell, on this depressing subject?

By way of consolation and encouragement —there are air-compressors which give indicator cards closely approaching the theoretically perfect.

These compressors are designed and built for economy—not to meet competitive prices nor to satisfy a low-price demand.

They are compressors representing progressive development through forty-two years of compressor building—therefore, they embody all that is good in compressor practice.

They are built of cast metals of extremely high quality, the result of long and costly experiment; of special high-carbon and alloy steels, oil-treated and heat-treated to the last degree of durability.

Their parts are machined by costly special tools, inspected by expert observers, and assembled by skilled mechanics, who maintain the best grade of workmanship.

They are tested by expert engineers, who insist that they shall be just right before they leave the shop.

These compressors bear the name "Ingersoll-Rand." It is this name—and this name only—which protects a buyer against excessive payments for wasted power.

CANADIAN INGERSOLL-RAND CO., LIMITED.

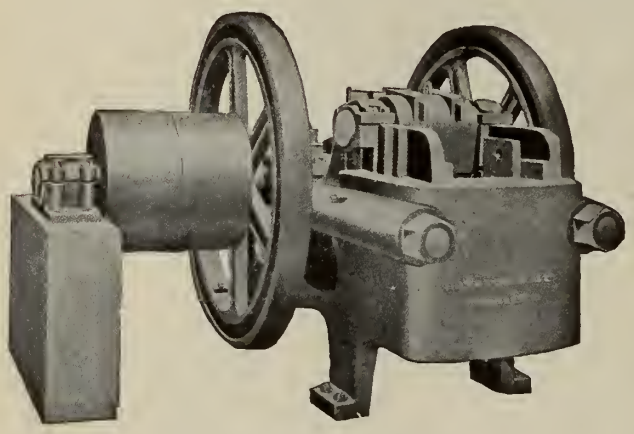
COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Sydney
Montreal
Toronto
Cobalt

Works:
Sherbrooke, Quebec.

South Porcupine
Winnipeg
Lethbridge
Nelson
Vancouver

BLAKE & DODGE
CRUSHERS

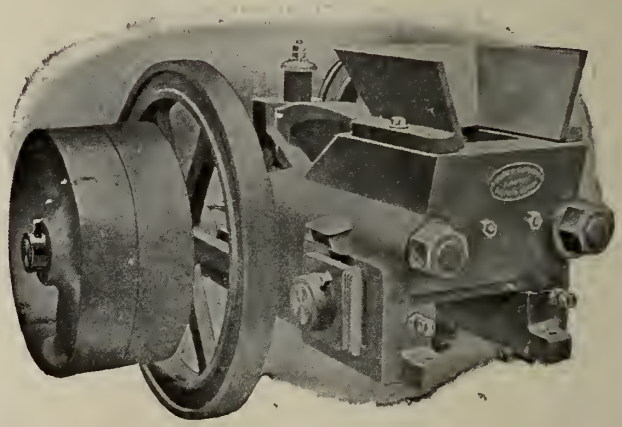


From 7" x 9" to 24" x 48"

WRITE FOR BULLETIN E-3

All Crushers are fitted with Manganese Steel Jaw Plates and Side Liners

Our Crushers are used in every Mining District in the World and are built for the most severe service



From 4" x 6" to 11" x 15"

WRITE FOR BULLETIN E-4

WE CAN MAKE IMMEDIATE SHIPMENT FROM MONTREAL STOCK

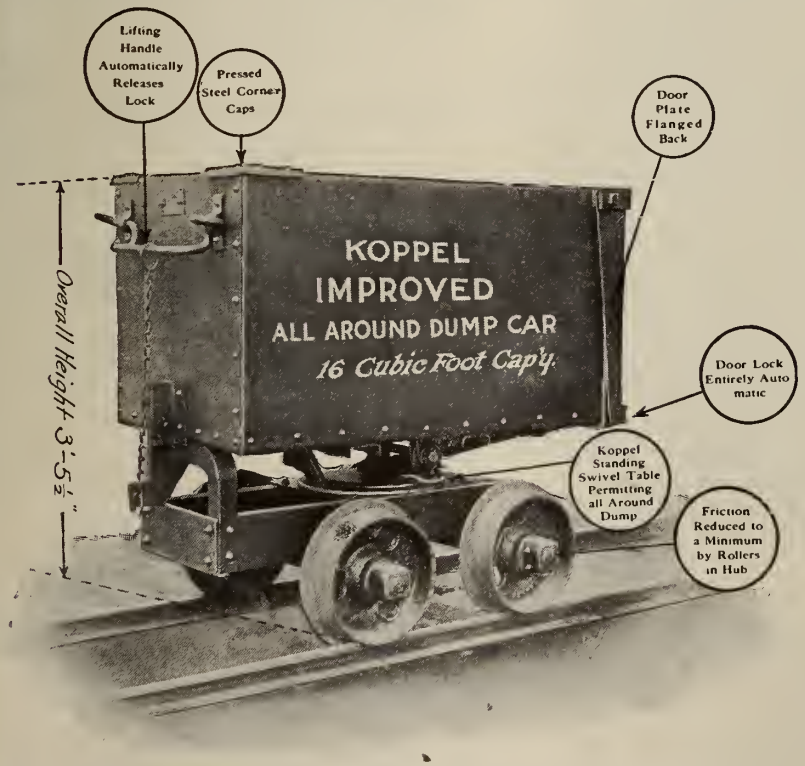
FRASER & CHALMERS

LIMITED

Canadian Branch:

4 PHILLIPS PLACE - - - MONTREAL, P.Q.

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Cap'y.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

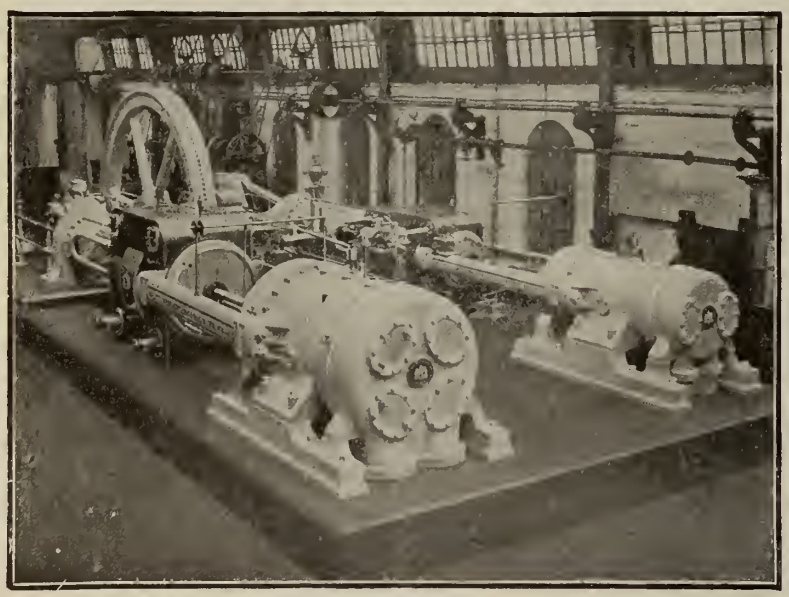
SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

THE SUPREME METAL
FOR WEARING PARTS

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N.B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

F. W. McNAIR, President

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

The Canadian Bank of Commerce

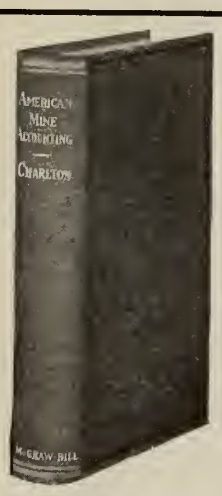
PAID-UP CAPITAL, $15,000,000
RESERVE - - 12,500,000

DRAFTS ON FOREIGN COUNTRIES

Arrangements have recently been completed under which the branches of this Bank are able to issue Drafts on the principal points in the following countries.

Austria-Hungary	Fr'ch Cochin-China	Norway
Belgium	Germany	Persia
Brazil	Great Britain	Phillipine Islands
Bulgaria	Greece	Roumania
Ceylon	Holland	Russia
China	Iceland	Servia
Crete	India	Siam
Denmark	Ireland	South Africa
Egypt	Italy	Straits Settlements
Faroe Islands	Japan	Sweden
Finland	Java	Switzerland
Formosa	Manchuria	Turkey
France	Mexico	West Indies and elsewhere

No Delay in Issuing. Full Particulars on Application.



American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages*, 6x9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

When you want

Steel Tanks

write us.

We are specializing in Steel Tanks and Steel Plate Work, built right at a reasonable price.

We Build any Size of:—
SETTLING TANKS, WASHING TANKS,
STORAGE BINS, COMPRESSED AIR RESERVOIRS.

Also for Special Mine Use:—
REVOLVING AND SHAKING SCREENS, ORE CHUTES,
STEEL BUCKET ELEVATORS AND CONVEYORS,
RIVETTED STEEL PIPE.

Our booklet "Steel Plate Work," just out, will interest you. Ask for it.

Send us your Sketches for Prices and Delivery.

The Waterous Engine Works Co., Limited

Brantford, Canada

1914

We shall appreciate your enquiries and orders for Assay Supplies during the year 1914.

LYMANS, LIMITED

(ESTABLISHED 1800)
MANUFACTURING CHEMISTS
Importers and Dealers in Chemical and Assay Apparatus
MONTREAL

Try a "Cleveland" Stope Drill

If we could make a demonstration for the superintendent and foreman of each different mine running stopes, we know we could convince them of the fact that the "CLEVELAND" is the best Stope Drill made—for we have been successful in so convincing every superintendent for whom we have made a demonstration, and have received his order.

A special demonstration in every mine is out of the question—but why not let us send you one for trial

IN YOUR OWN MINE

so you can find out for yourself what it will do.

Write for Bulletin 40A.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street, TORONTO

GREENING'S WIRE ROPE

Our Mining Ropes are especially constructed to suit the requirements for HOISTING or HAULING.

Crucible Cast Steel
Best Plow Acme Brand,
extra high breaking strain for deep shafts.

Regular Lay **Lang's Lay**

Wire Rope Fittings
Wire Rope Grease

ASK FOR OUR NEW ROPE CATALOGUE

The
B. Greening Wire Co.
Limited

Hamilton, Ont. - Montreal, Que.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 14" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: **NEW GLASGOW, NOVA SCOTIA**

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 kindly send in your order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Won't this ROBB

MINE HOISTING ENGINE

just suit you ?

Two Robb-Armstrong side-crank engines, 22 inches diameter by 42 inches stroke. Engine bearings hard babbit.

Two Drums 8 feet in diameter, 58 inches wide. Bronze sleeves.

New, complete, with steam brake, steam-operated clutch, throttle valve, etc.

FULLY GUARANTEED.

For Photos, Drawings, etc., write to

International Engineering Works Limited

AMHERST, N.S.

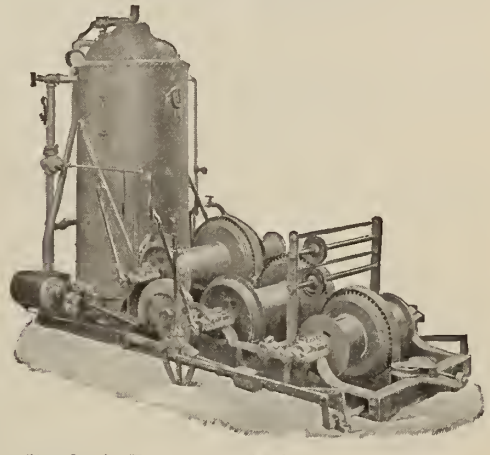
Transportation Building. Montreal

Traders Bank Building, Toronto

39-49

"BEATTY HOISTS"

STEAM OR ELECTRIC.



Standard Two-Drum Hoist with Swinger.

This represents one of many types we are prepared to furnish on short notice. Proof of their being built right and giving satisfaction, lies in the fact that a large portion of our business is made up of repeat orders.

If interested in a Hoist, Williams Faivrette Clamshell, Steel Derrick, or Centrifugal Pump, drop us a line—we'll send full particulars.

M. BEATTY & SONS, Limited

WELLAND, ONTARIO

AGENTS:—E. Leonard & Sons, St. John, N. B., and Calgary, Alta.; H. E. Plant Montreal Que.; H. W. Petrie, Ltd., Toronto; R. Hamilton & Co., Vancouver, B.C.

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records

Year by year they increase by Leaps and Bounds.

The Reason :

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

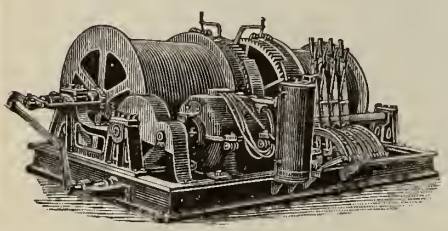
HEAD OFFICE AND FACTORY TORONTO BRANCH FACTORIES WINNIPEG AND MONTREAL

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

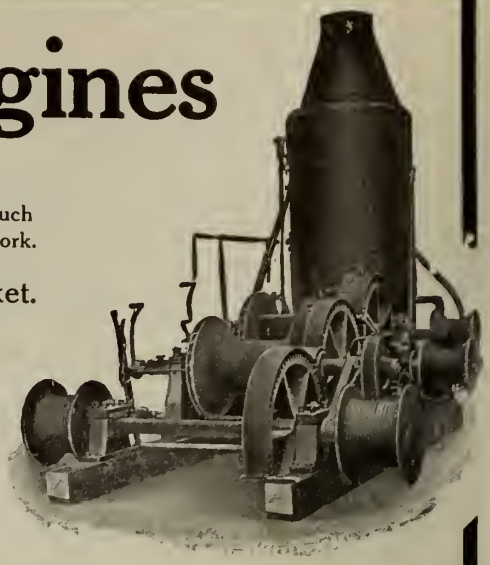


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



ASK FOR OUR CATALOGUES

S. Flory Mfg. Co.

Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

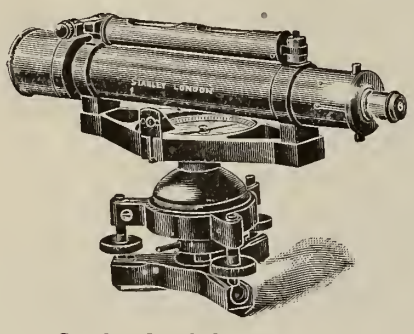
SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade **STANLEY** Mark

The largest manufacturers of

Surveying and Drawing Instruments

in the world.



"Stanley Quick-Setting-Up Level"

Please send for our K 35 Catalogue (post and duty free) and compare our prices with those of other first-class makers.

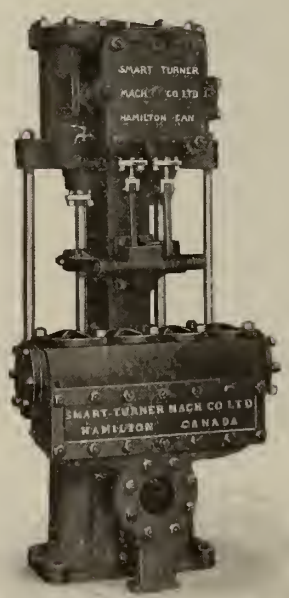
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, London, W.C.

Head Office and Showrooms:

286, High Holborn, London, England

"THE PROOF OF THE PUDDING"



Try one Pump of our make and you will be convinced of the desirability of making it your standard.

The Smart Turner Machine Co.

LIMITED

Hamilton, Canada

BAGS!

Jute Cotton Duck

FOR

ASBESTOS COAL ORE

CONCENTRATES

FLOUR GRAIN FEED

PRINTING A SPECIALTY

The Canadian Bag Company Limited

Head Office: Montreal

TORONTO WINNIPEG

Amatite ROOFING

Best for Mine Buildings

AMATITE is made so as *not to need painting*. It has a real mineral surface which is better than paint. It consists of mineral particles gripped in a firm, tough matrix of pitch—*the greatest waterproofing material known*.

The mineral matter and the pitch form, in fact, a sort of plastic concrete which is thoroughly weatherproof and needs no painting.

Amatite is worth much more to you than any roofing which requires painting every two years. You could well afford to pay a higher price for it. Nevertheless Amatite actually costs *less* than painted roofings of even less weight and will last longer.

The value of a "no paint" roofing, as contrasted with the various painted kinds, is so obvious that Amatite has attained great popularity.

Sample and illustrated booklet free on request.

THE PATERSON MFG. CO., Limited

Montreal, Toronto, Winnipeg, Vancouver, St. John, N.B., Halifax, N.S. Sydney, N.S.

School of Mining

AND

COLLEGE OF APPLIED SCIENCE

AFFILIATED TO QUEEN'S UNIVERSITY

KINGSTON - - ONTARIO

1. Four Years' Course for a Degree (B.Sc.) in
   - (a) Mining Engineering.
   - (b) Chemistry and Mineralogy.
   - (c) Mineralogy and Geology.
   - (d) Chemical Engineering.
   - (e) Civil Engineering.
   - (f) Mechanical Engineering.
   - (g) Electrical Engineering.

For Calendar of the School and further information apply to The Secretary, School of Mining, Kingston, Ontario.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and

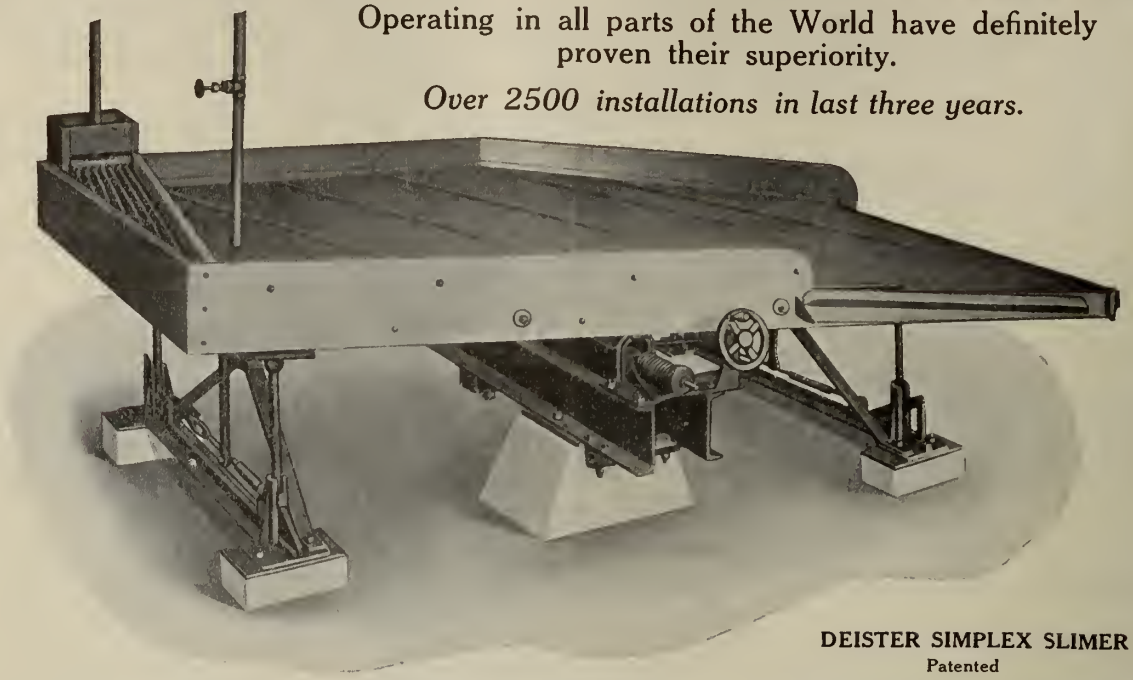
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

DEISTER SAND AND SLIME TABLES

Operating in all parts of the World have definitely proven their superiority.

Over 2500 installations in last three years.



DEISTER SIMPLEX SLIMER
Patented

WRITE FOR FULL DATA

Deister Machine Co.'s Tilting Slimer for Fine Slimes. Deister Machine Co.'s Classifier for Coarse and Fine Material

DEISTER MACHINE COMPANY, SOLE OWNERS AND MANUFACTURERS

Head Office: Shoaff Bldg., Fort Wayne, Ind., U.S.A. London Office: 562 Salisbury House, London Wall, E.C.

THE PARRAL TANK SYSTEM OF SLIME AGITATION

Parral Tank

Patented in
The United States, Canada, Mexico, etc.

No Bridge or Side Structures
No Belts or Gears
No Interior Moving Parts
No Centrifugal Pumps

Canadian Patent No. 139,537

Most Efficient—Most Economical—Simplest

Modus Operandi

The pulp is continuously transferred by compressed air through the lift pipes from top to bottom of the tank charge where its spouting force creates a Rotary flow which extends from top to bottom of the charge, keeping the solution and solid constituents in proper proportional mixture throughout the treatment period.

Cyanidation

Employed successfully for years in Cyanide Plants agitating the slime-pump of Gold and Silver ores.

Copper Ore and Flue Dust

This is the only practical system for agitating the slime of Copper Ore and Flue Dust in acid solution. For this purpose the tank, transfer-pipes and air nozzles are made entirely of wood.

Agitation, settlement, decantation dilution, re-agitation and water-washing in same tank or in any series of tanks designed by metallurgists.

Write for full particulars to

Bernard MacDonald, 1005 Fair Oaks Ave., South Pasadena, California

The Jenckes Machine Co., Sherbrooke, Que.,

Canadian Manufacturers

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

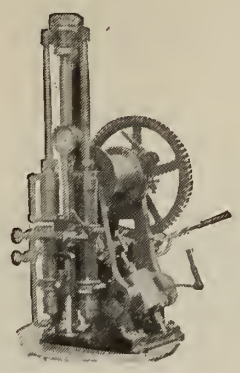
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

The Capell Patent Fans

UNDER IMPROVED PATENTS

1,600 Mine Fans in use.
Highest Water Gauges and Largest Outputs.

All enquiries to

THE CAPELL FAN CO.

13 MOSBY ST., NEWCASTLE-ON-TYNE, ENGLAND

¶ Complete Bound Copies for 1912 Canadian Mining Journal, with Index, are now ready. Price $5.00 per volume. Canadian Mining Journal, 44-46 Lombard Street, Toronto.

C. L. BERGER & SONS

37 Williams Street
BOSTON, - MASS.

SPECIALTIES:
Standard Instruments and Appliances for
Mining, Subway, Sewer and Tunnel, and all kinds of Underground work.

SEND FOR CATALOGUE

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.

Back or Current Numbers

of any American or Foreign technical or trade Journal furnished on short notice at moderate rates; also newspapers and magazines. Government and State Reports of all kinds in stock. Clippings on special subjects furnished promptly. Magazines and papers of all kinds bought.

Special subscription price list on request.

A. W. Castellanos
263 Armstrong Avenue
Jersey City, N.J., U.S.A.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

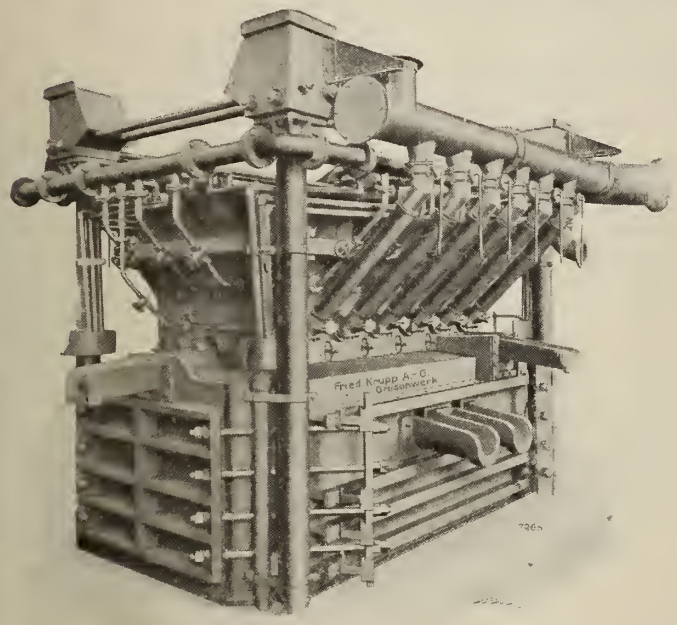
DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

FURNACES AND ACCESSORIES FOR SMELTING PLANTS AND METAL WORKS.



Sinter Roasting Furnaces, Water Jacketed Furnaces, Converter Plants, Refining Furnaces, Desilvering Plants, Gold Refining Plants, Blast Furnace Hoists, Fore Hearths, Slag Trucks, &c. :: :: :: :: ::

Equipment for Recovering Metal from Sweeps and Junks.

REVERBERATORY MELTING FURNACES.
for Fining and Re-melting Copper, Brass, &c.

Crucible Furnaces, Re-heating Furnaces, Annealing Furnaces, Gas Producers, &c.

FRIED. KRUPP A.-G. GRUSONWERK

Magdeburg, (Germany.)

CANADIAN REPRESENTATIVES

JAS. W. PYKE & CO., LIMITED. 232 St. James Street, MONTREAL

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

TEMISKAMING AND NORTHERN ONTARIO RAILWAY

(ONTARIO GOVERNMENT RAILWAY)

SIR JAMES P. WHITNEY, Premier

Toronto, Montreal through Sleeping and Dining Cars to Timagami, Cobalt, Englehart, Elk Lake, Porcupine, Cochrane, traversing the far-famed Timagami Lakes---the Sportsmen's Paradise.

Through the rich and well-known Cobalt silver and Porcupine gold districts. Through the great clay belt---20,000,000 acres of rich agricultural lands await the settler.

For full information, pamphlets, time tables, etc., apply:—

GEO. W. LEE,
Genl. Agent,
North Bay, Ont.

A. J. PARR,
G. F. & P. A.,
North Bay, Ont.

FRED'K DANE,
Land Commr.,
Toronto, Ont.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address : SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

TRANSMISSION STORIES
Mechanical Regrets

That the unexpected is occasionally pleasant is a fact recently discovered by a mine manager* in a certain Ontario mining camp. On a section of the mine they used to use a gear driven pump ; it proved, however, insufficient to cope with the expansion of this prosperous mine ; a new pump was ordered, but to be equipped with a Renold Silent Chain, as they wished to eliminate, if possible, trouble previously experienced with gears ; before, however, the new pump arrived, the gears of the old pump shed their teeth.

THEN

a Renold Silent chain was immediately fitted to the old pump, and to the mine manager's astonishment, not only did the noise and vibration cease, but the capacity of the pump was so increased that it was not necessary to install a new pump at all.

THERE'S A MORAL

Does this story suggest a cure for your transmission troubles? If so, write and tell us.

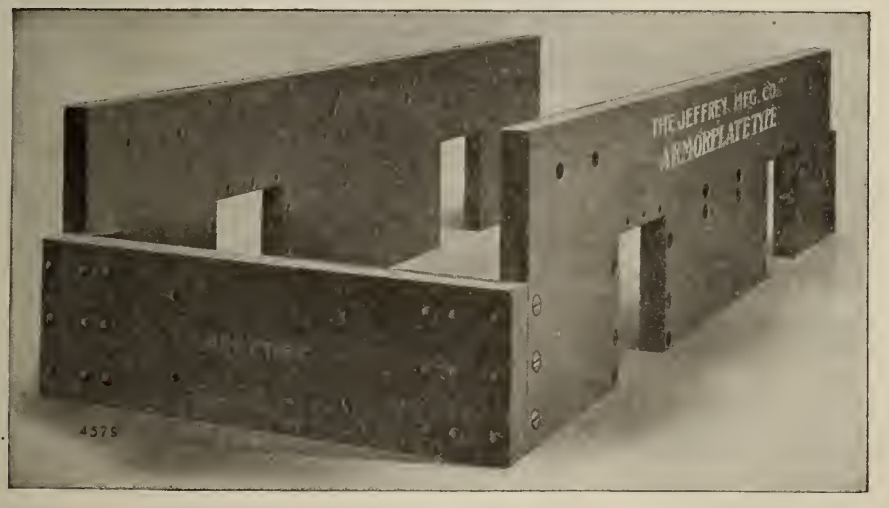
JONES & GLASSCO (REG'D) Engineers

Sole Canadian Agents—RENOLD PATENT SILENT CHAINS

49 Place D'Youville, MONTREAL. Branch Office, Toronto.

*Name on application.

48



The Jeffrey *ARMORPLATE* Type Frame

allows the greatest per cent. of weight to be used for motor equipment for a given weight of locomotive.

The Solid Steel Slabs are indestructible. They give absolute protection to motorman and equipment—entirely eliminate the breaking of castings due to head-on collisions, or leaving the rail and striking the rib.

This type of frame is used on Locomotives from seven tons up to and including twenty tons weight.

The Cost of upkeep for this construction is a minimum.

Send for Catalog No. 117 on our Complete Line of *STANDARD* Locomotives.

JEFFREY MANUFACTURING COMPANY

Canadian Main Office and Works:—MONTREAL

SIX FEET of SHANKS

BROKEN EVERY DAY

This is the advice of a large mining company who have been using drills with the old-fashioned chuck requiring shanked steels.

Look at These Resulting Costs:

Average length of shank broken -	6 ins.
Number of shanks in 6 feet - -	12
Cost of the 6 ft. of 1⅛ in. Oct. drill steel wasted 20 lbs. at 7½c. -	$1.50
Time required to re-shank 12 steels: 12 shanks @ 20 min. - 240 min. or 4 hrs.	
Labor cost, blacksmith and helper, per hour, - -	60c.
Total labor cost re-shanking 12 drills 4 hours' work, @ 60c -	$2.40
Total cost of steel wasted - -	$1.50
Total Waste per day -	**$3.90**

HOLMAN DRILL ON QUARRY WORK

HOW LONG WILL YOUR PROFITS STAND THIS WASTE?

By using the Holman Steel Rock Drill Equipped with its Patent Chuck you need not shank your steel. *Estimate the saving.*

The Holman is the Drill You Will Finally Buy

WRITE FOR CATALOG J51 TO THE SOLE CANADIAN AGENTS:

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 318 Richards St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, January 1, 1914. No. 1

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 34B Board of Trade Building
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor

REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

Editorials—	Page
The Year 1912—A Review	1
Cobalt and Porcupine	2
Oxygen Breathing Apparatus	2
A Visit to Some Pacific Coast Mines. By E. S. Moore	5
The Chisana (Shushanna) Gold District. By D. D. Cairnes	9
The Metal Cobalt and its Alloys. By H. T. Kalmus	11
Oxygen Breathing Apparatus. By F. W. Gray	13
Oxygen Breathing Apparatus, with and Without Injectors. By Dr. Forstmann	14
The Consolidated Mining & Smelting Co. of Canada	18
Smelting the Cobalt Silver Ores. By A. A. Cole	20
Storage and Measuring Pockets at Negaunee Mine. By S. R. Elliott	22
Book Reviews	24
The Modern Rock Drill. By W. L. Saunders	25
Personal and General	28
Special Correspondence	29
Markets	36

THE YEAR 1913

A Review

The past year has witnessed substantial growth in the mining industry. The output was large and good prices were obtained for most of the products.

The Nova Scotia coal and iron industry has been fairly successfully carried on as far as output is concerned. The demand for the furnace products has, however, been slack for some months and low prices rule.

In Quebec many of the asbestos mines have been worked profitably. A considerable number are, however, still idle.

In Ontario the nickel, copper, silver and gold output was large and there were important new developments at Cobalt, Sudbury and Porcupine.

In British Columbia the copper, gold, lead and silver production was large and the chief copper producers had an unusually profitable year. The coal mines of Alberta and British Columbia made good records with the exception of those on Vancouver Island.

A strike of coal miners on the Island was accompanied by acts of violence that make the strike stand out as a conspicuous dirty page on an otherwise clean and encouraging year's record. The Nova Scotia miners, by peaceable means, have achieved much better results than have the Vancouver miners by violence.

Geological Congress in Canada.—An event of unusual importance to mining men in Canada was the session of the International Geological Congress held this year. Numerous excursions to the mining districts were held in connection with this meeting of geologists and mining men, who came from all parts of the world. The publicity thus given to our mineral industry cannot fail to bring good results.

Legislation.—The bill providing for a Federal mining law has been under consideration during the year, and is expected to come before the House at an early date. In Ontario two noteworthy changes in the laws affecting miners, one enacted and the other in the form of a final report, soon to be discussed by the Legislature, are attracting attention. The first, which goes into force on January 1, 1914, requires that underground miners be not required to work more than eight hours per day. The second, not yet passed, provides that conpensation for workmen injured is to be paid from a fund to which the employers and the Government will contribute.

Canadian Mining Institute.—Members of the Institute are taking into serious consideration the problem of providing suitable headquarters. It is expected that the present inadequate rooms will soon be given up. As

the Montreal members are planning to raise funds for suitable quarters for the branch, this is considered an opportune time to take steps towards securing permanent headquarters.

In addition to the question of ways and means it will be necessary for the members soon to decide where permanent headquarters should be established. For some time the Secretary's office has been in Montreal, and many will prefer that the location be not changed. Many others, owing to the increasing prominence which Ontario is taking in mining affairs, would like to see the headquarters of the Institute established in Toronto. Many arguments can be, and doubtless will be, advanced in favor of either location. It is not unlikely that the Institute will be called upon to take definite steps on the headquarters question during the coming year.

Another subject which is engaging the attention of members of the Institute, and which will have to be discussed by the Council during the coming year, is the proposed Compensation Act for Ontario. While the bill proposed is, on the whole, a reasonable one, there are some details which will not meet with the support of many members.

During the past year there has been no regular publication of bulletins. More prompt publication of papers presented would be very desirable.

Government Surveys.—The past has been a rather unsatisfactory year as far as field work is concerned. Owing to the great amount of work in connection with the Geological Congress the regular work of the several Federal and Provincial surveying departments has been somewhat neglected.

The work done in compiling and publishing the numerous reports and maps in connection with the Congress excursions has, however, in a measure offset the regrettable lack of new field work. The available knowledge has been collected and the maps corrected. The brief up-to-date summaries will make a very useful basis for future work.

PORCUPINE AND COBALT

Very encouraging results have been obtained recently at Porcupine and Cobalt.

A new impetus has been given to development in the Kerr lake section. The draining of the lake resulted in the discovery of a splendid vein of rich ore and the prospects for other important discoveries are very good. At the east end of the lake the Caribou-Cobalt and Drummond Fraction properties are being developed. Now that the lake has been drained the Crown Reserve and Kerr Lake Companies will be able to safely mine from near the surface a large tonnage of rich ore from veins that have been already mined at lower levels. There is good reason to believe that the Kerr lake section of the Cobalt silver area will give a good account of itself during the coming year.

At Porcupine there is every evidence that gold production is soon to be largely increased. At the Dome mine forty new stamps are being placed on their foundations. Preparations are being made for the erection of large tanks for the leaching of sands. During the past few months the output of the present 40 stamp mill has been increased to about 480 tons per day With the additional 40 stamps and the sand leaching plant there is good reason to expect that in a few months the mill will be treating 800 tons per day.

At the Hollinger development is proving satisfactory and arrangements are being made for the more rapid development of the adjoining property of the Acme Gold Mining Co.

The McIntyre has been obtaining better results lately. The Porcupine Crown is meeting with much success and has recently installed a very satisfactory cyanide plant. The adjoining North Thompson lot is being vigorously explored by new owners. The Schumacher has been recently equipped with an up-to-date plant.

It is probable that much more mining will be done in the Porcupine goldfield during the coming year than during the past, and that the gold output will be much increased.

OXYGEN BREATHING APPARATUS

In this issue Mr. F. W. Gray discusses criticisms of the rescue-apparatus now in common use in this country. His comments are reassuring and go to show that the chief cause of failure is not defective apparatus, but rather carelessness in keeping and using it. He points out that the apparatus should be carefully kept and frequently tested and that it should not be used by anyone not thoroughly familiar with it.

Mr. Gray's remarks have special interest, as he was the first person on this continent to bring over a rescue apparatus of the oxygen type. He was educated at the colliery where the first rescue station in Great Britain was established, and has seen the development of rescue apparatus from the old Giersberg-Walcher apparatus in 1901 to the present perfected types.

CONCENTRATES

Under this heading our esteemed contemporary, The Mining and Scientific Press, San Francisco, publishes short paragraphs on many subjects. In the November 15th issue we find the following:

"Kieselguhr is one name for fuller's earth, which usually is a diatomaceous earth, made up of the minute silicious skeletons of diatoms. It is also known as Tripolite, and by various trade names. Aside from its proper uses as a bleaching agent and as an absorbent for unstable materials, as when used in making dynamite, it is frequently employed as an adulterant and for 'loading' cloth and other materials. The compact varieties are cut into filters and it is also crushed for use as a polishing material and for making heat-protect-

ing packing for pipes. Large quantities are used in the chemical industries such as the making of water glass, paper, pigments, safety matches, and papier mache. It occurs in many parts of the world, and deposits have recently been reported in Chile where they may be of importance in the local manufacture of dynamite."

The concentrating machinery of the "Mining and Scientific Press" has not been very successful in treating kieselguhr. The product can scarcely be called a concentrate.

Fuller's earth is a claylike substance, used originally for the fulling of cloth; but now chiefly used in bleaching, clarifying or filtering fats, greases and oils.

Kieselguhr is the siliceous absorbent commonly known as infusorial earth. In England the terms 'infusorial' earth and 'tripoli' are used for the fine sediments consisting of the fragments of the remains of certain aquatic plants known as diatoms. By the U. S. Geological Survey the term 'infusorial' earth is used for such deposits; but the term 'tripoli' is used for a porous siliceous rock supposed to have resulted from the leaching of calcareous material from siliceous limestone.

SLOCAN STAR MINES, LTD.

At the second ordinary general meeting of shareholders of the Slocan Star Mines, Ltd., operating the Slocan Star silver-lead mine, situated near Sandon, Slocan district, British Columbia, the following report of the directors was submitted:

"Your directors herewith submit the second annual report of the operations of the company, financial statement of accounts and balance sheet, together with the auditors' report for the year ended October 31, 1913.

"The operations of the company during the year have been confined largely to development work, with very satisfactory results.

"At the annual meeting a year ago your directors reported that at a distance of 2,100 ft. from the portal of the No. 10 crosscut tunnel, the vein was struck on September 7, 1912, and that since that time, drifting on the vein to the east had proceeded for the purpose of encountering the central ore shoot on its downward continuation. Since then, a working raise has been made 444 ft. up from No. 10 drift to connect with No. 6 level and from this raise levels Nos. 7 and 8, about 100 ft. apart, have encountered at depth the vein which contains ore similar in character to that shipped from the upper levels. Shipments were made during the course of, and from, such development amounting, at the close of the fiscal year, to a gross value of $28,732.37.

"Details of the work and results obtained will be submitted to the meeting in the report of Mr. Oscar V. White, mine superintendent.

"The most striking development has taken place in No. 8 level where a shoot of high-grade silver lead ore was encountered early in the month of October last. The superintendent reported this ore body to contain 2 ft. of clean ore and 4 ft. of concentrating ore. This shoot has been drifted upon east and west for a distance of approximately 100 ft., and at this date the drift has ore in both faces similar to that reported, while the eastern face shows that it has widened to about twice the width.

"Your President, in company with Mr. Andrew G. Larson, M.E., consulting engineer, visited the property early in November last and fully confirmed the superintendent's report. Since that time drifting has been commenced from No. 10 level with a view to finding this ore shoot at greater depth.

"The mine development for the year consists of 757 ft. of crosscutting, 844 ft. of drifting, and 444 ft. of raising, or a total of 2,045 ft. of development work.

"During the month of November, 112 tons of high-grade ore was shipped. Returns for this have not yet been received. It is expected that larger shipments will be made as soon as the necessary arrangements have been made for stoping.

"It is proposed to continue development, also shipment of clean ore during the winter and to operate the concentrator in the spring when water shall be available and the flume lines have been repaired, as the tonnage now in sight in the mine is sufficient to keep the mill in continuous operation for a considerable time.

"It should be mentioned that for some months past the mine has been on a self-sustaining basis and with the present outlook it can confidently be expected to discharge all obligations and provide a substantial cash reserve for the development of the eastern and western ore shoots during the year, whereupon, it can be reasonably expected that the property will be upon a dividend-paying basis.

"Your directors desire to point to the fact that the development work outlined in the report of Mr. Larson, made at the time of the consolidation of the Slocan Star and Rabbit Paw groups of mines, has been fully justified by the results obtained under the capable supervision of the mine superintendent, whose conduct of the mining operations calls for an expression of much satisfaction from your directors."

The meeting was held at the registered office of the company in Vancouver, B.C., on December 19.

TITANIFEROUS IRON ORES.

Mr. Joseph T. Singewald, in a bulletin published by the Bureau of Mines, U.S.A., says that there is little hope that such ores can be treated in the blast furnace; but that some may be treated successfully in the electric furnace.

The evolution of the modern blast furnace has taken place in such a direction as to make the utilization of titaniferous iron ores impracticable. Notwithstanding numerous experiments that have been conducted with a view to discovering a furnace charge that will make the use of these ores practicable from the standpoint of furnace operation and economy, there is to-day no hopeful feeling in regard to the possibilities of smelting these ores in the blast furnace. On the other hand, the introduction of the electric furnace holds out a new hope for the direct reduction of the titaniferous ores.

The results of magnetic-separation experiments conducted with these ores are very promising in some cases and extremely disappointing in others. No rule of general application can be formulated as to the behavior of the ores. Some deposits are very amenable to magnetic separation, and yield concentrates that require the admixture of only a small proportion of non-titaniferous ores to make a satisfactory ore mixture. Other deposits are less amenable and yield concentrates that would have to be mixed with three or four parts of non-titaniferous ores for furnace use. There are many other deposits in which the percentage of titanium separable in this way is extremely small, so that the utilization of

such ores seems to depend on the discovery of a process that will make their use feasible.

The cause of the difference in behaviour of the ores toward magnetic separation is revealed in their microstructure which is readily studied by the metallographic method. This method of investigation shows that the titanium occurs in these ores in the form of ilmenite grains in about the same order of magnitude as the magnetite grains, as ilmenite inclusions and intergrowths of microscopic size in the magnetite, and as an integral part of the magnetite molecule itself. The titanium occurring in the first form (as ilmenite grains) is readily separable by means of magnetic concentration, excepting in the finest grained ores with which the degree of crushing required would make such concentration impracticable. The titanium occurring in the two latter forms is inseparable by mechanical means. The percentages of titanium occurring in these different forms varies greatly in the different ores, and, consequently, every case must be tested for itself. A metallographic study of the ores of any deposit will at once decide the question of the amenability of the deposit to magnetic separation.

As regards chemical composition, except for their titanium content, the ores are very desirable. The coarser-grained ores are usually high grade in their natural condition, whereas a magnetic separation of the leaner ores yields a high-grade concentrate, with the deleterious constituents at a minimum.

As the iron industry at present demands large deposits of definite extent, the outlook for most of the deposits of titaniferous iron ore in the United States is not promising. As a rule, the deposits are relatively small and of irregular extent and distribution. Further they are lean to medium grade, and inaccessibly situated as regards transportation facilities. In other words, to put the deposits on a producing basis would require a heavy initial outlay of capital, which the size and irregularity of occurrence does not warrant. There are, however, the two large, high-grade deposits of Sanford Hill, N.Y., and Iron Mountain, Wyo., which are so readily workable that, despite their titaniferous character, their utilization within a few years seems certain.

IRON ORE IN MICHIGAN AND BRAZIL.

Michigan.—In the government suit against the United States Steel Corporation, Professor Leith, of the Geology Departments at the Universities of Chicago and Wisconsin, stated on the stand in court at New York last month that of all the available iron ore in the Michigan districts the Steel Corporation in 1911 owned about 30 per cent. and less in 1912. This offset the contention by the government that the corporation had a monopoly. Professor Leith said that in the last thirteen years the shipments from the Michigan mines had totalled about 130,000,000 tons. The Steel Corporation has been least active in developing and purchasing new ore reserves in old range properties in recent years. He named several companies, including the Cleveland-Cliffs, Pickands-Mather, Rogers-Brown, M. A. Hanna and others, which had done much more exploration work. The Cleveland-Cliffs Company controls about twice as much ore reserve in the old ranges as does the corporation, he testified.

Professor Leith said that if a new steel company wanted a fifty-year supply of ore, or about 100,000,000 tons, it could easily procure it in the Lake regions from one property now on the market, not including the Hill ores, or those held by independent companies or those not yet developed. On account of the large supply now available, little development is now going on. The merchant ore mining companies are not at present able to sell their capacity output in the open market. Regarding competition in ore, the witness said that some of the larger independents, including Jones & Laughlin, Lackawanna and Inland Steel, have recently added to their ore holdings, without causing a ripple in the ore market. It is not possible for any one company to obtain a monopoly of iron ore in the Superior district. Such a procedure would only cause greater exploration by companies which wished to sell to the company attempting the corner and would bring to light enormous additional supplies.

Brazil.—The witness, who had visited the Brazil ore regions, said the best grades in Brazil run as high as 69 per cent. in iron and very low in phosphorus. Of the highest grade hematite ore it is estimated that in the Riodoce valley alone there is about 600,000,000 tons in sight without going lower than the lowest outcropping. At a depth of 600 feet he estimated 1,000,000,000 tons revealed. Of soft ore, running 64 per cent. iron, in the same locality, there is about 365,000,000 tons proved and about 1,000,000,000 tons as a conservative estimate at less than 600 feet. Of the highest grade ore there is about 2,000,000,000 tons so far brought to light in that district. The district is tapped by several railroads, including the National Railways of Brazil, these roads entering a territory well supplied with high grade ore. Of surface or blanket ores, which cover the surface about fifty feet thick and for several square miles, running 54 to 64 per cent. iron content, about 1,000,000,000 tons is available at present.

In all Brazil, Professor Leith estimates about 4,000,000,000 tons of ore showing 64 per cent. iron or better. This ore is practically in sight and does not have to be drilled for and is more than twice what is estimated of the same class in the Superior district, both in sight and as shown by drillings at a maximum depth of 2,700 feet. Professor Leith said this district has climate the most healthy in Brazil, and is the most thickly populated. A company is being exploited to ship this ore to Atlantic coast ports here and to European ports at a cost of eight to nine cents per unit. He estimated the steamship haul from Victoria to New York at about $3 per ton, compared with the present rate of about $2.75. The new company will have a line of vessels, docks at Victoria and a railroad from Victoria to the mines.

The Tacoma Steel Co. is continuing the development of its Marble Bay mine, situated near Van Anda, Texada Island. The ore is bornite and chalcopyrite, generally occurring in pockets or lenses in limestone. In parts native silver has been found freely associated with gold and much copper. Ore is being mined at the 1,300-ft. level (incline), which is at a vertical depth of more than 1,000 ft. The occurrence of bornite at this depth is of interest to mining men, some of whom are not accustomed to finding it at so comparatively great a depth. Local men are working the neighbouring Cornell mine on lease and are mining some nice ore. Not much has been done lately at the Little Billy mine, while the Copper Queen has been idle a long while. All these mines are situated in the northern part of Texada Island.

A VISIT TO SOME PACIFIC COAST MINES

(Notes on Excursion C8 of the International Geological Congress.)

By E. S. Moore.

On the evening of August 28th, the C8 excursionists, numbering over 40, left Vancouver on the special steamer, Princess Maquinna, for Yakutat bay and the Klondike. On reaching Prince Rupert the party divided, a few going up the Skeena to Hazleton, on the new G.T.P. line, while the remainder visited the Hidden Creek copper mine. Prince Rupert proved of special interest to the foreign geologists because it illustrated in such a striking manner the development of a new town in Western Canada. The building of houses and streets among and over the stumps and the blasting away of whole hills of rock to make room for buildings and roads were all works of unusual interest. The fact that such a fine harbour is being opened more than four hundred miles nearer Japan than any other large harbour on the Pacific coast will have an important bearing on Canadian commerce.

Hidden Creek Mine, Granby Consolidated Co., B.C.

The Hidden Creek Copper Mine.

This mine on Granby bay near the northeast end of Observatory inlet, has been quite recently opened. It is owned by the Granby Consolidated Mining, Smelting and Power Company. Since it is situated within a mile and a half of a good harbour it has splendid shipping facilities and should have a rapid development. Mining operations are still in their infancy, but over 30,000 ft. of diamond drilling and 17,000 ft. of tunnelling and drifting are stated to have shown the presence of three ore bodies, with at least 7,500,000 tons of 2 per cent. ore, above the 150-ft. level. Higher grade ore running as high as 8 per cent. is said to have been found below sea-level.

The ore minerals are pyrite, pyrrhotite and a smaller percentage of chalcopyrite in a gangue of quartz, schist and argillite. In No. 1 ore body a little calcite occurs with the slate. Small quantities of graphite lie along slicken-sided surfaces. The deposit is cut by a number of dikes varying, where seen by the writer, from 4 inches to 4 ft. in width and consisting of what appeared in the hand specimen to be basalt and minette. The dikes seemed to be more numerous in the ore body than in the surrounding rocks, and this may be due to the fact that the ore is more brittle than the adjacent rocks and that the ore body has been developed in a weak area in the strata. They are generally vertical or nearly so.

The topographic relief of the Hidden Creek area is considerable, the mountain tops being bare and snow-covered, while the lower levels are covered with forest of hemlock, spruce and cedar. The timber is large enough for lumber, but it is comparatively soft and it was stated by one of the engineers that where an 18-inch "shooting post" would stand the strain at Phoenix, a 22 to 26-inch post is required at the Hidden Creek camp, because of the softer character of the wood.

Following the principle adopted at Phoenix of keeping the cost of labour and of mining low, by employing automatic, mechanical devices for handling the ore, the company is installing a very efficient system. All the crushing machinery is placed underground in the 150-foot level, and this tunnel will be used for shipping purposes. A 2,000-ton smelter is under construction near the coast.

The West Coast to Yakutat Bay, Alaska.

From Prince Rupert thirty-eight passengers turned northward to Alaska and the Yukon, while the remainder of the party returned to Vancouver. The chief points visited on the northern journey were the mines on Douglas Island, the faults and glaciers near Yakutat bay, the glaciers on Glacier bay, and the gold deposits of the Klondike district.

The mines on Douglas Island are commonly known as the Treadwell mines, but they include the properties of several companies, viz.: the Alaska-United, the Alaska-Mexican, and the Alaska-Treadwell. These companies are all under one management, but each has its separate mill. The output is about 5,000 tons per day and these rank among the largest gold mines in the world. They are, however, surpassed in output by some of those in South Africa, and possibly by others. On the opposite side of the bay from these mines and just behind Juneau some deposits are being opened up which will rival if not surpass these. The ore, which consists of gold-bearing pyrite in quartz and "albite-diorite," is stamped, passed over the Frue Vanner tables, where about 50 per cent. of the gold is said to be extracted, and the concentrates are then passed on to the cyanide plant. It was in this cyanide plant that the air agitated tanks, which work so successfully, are said to have been first employed.

The ore body is very large and it takes the form of a great, light coloured dike with greenstone on one side and slate on the other as contact rocks. On account of the large size of the ore body and the very efficient system of mining, the ore is handled as cheaply, if not more cheaply, than elsewhere on the continent. The Homestake mine, in South Dakota, is reported to run about the same. The average value of the ore mined is only a few cents over $2.00 per ton. Oil is used as a fuel with very satisfactory results.

Yakutat bay and vicinity has many points of special interest. The Malaspina glacier, the largest of piedmont type in the world, the panorama of the St. Elias range, conceded to be the most beautiful to be found anywhere, and the recent faults, all go to make this a veritable garden for geologists. The faulting seems undoubtedly to have occurred at the time of the great earthquake in September, 1899. The sea coast along Disenchantment bay rose 47 feet and the shore of Haenke Island now stands 18 feet 6 inches above its former position. The faulting near Nunatak glacier largely took the form of step faulting, and some of the steps show throws between four and five feet. A prospector made the complaint that he had lost a remunerative beach placer by its sinking beneath the sea during this disturbance.

Skagway to Dawson City.

Pueblo Copper Mines.—Near Whitehorse, in the Yukon Territory, the party visited the Pueblo copper mines. These mines show large bodies of oxidized ores with a very interesting set of contact metamorphic minerals. The ore minerals consist chiefly of malachite with lesser amounts of bornite, azurite and cuprite in micaceous hematite or magnetite. At the mine it is hematite, while at the "Best Chance" prospect it is magnetite, the latter sometimes banded with garnet and diopside. The ores lie near the contact of granodiorite and limestone, both of which are considerably altered, the former showing a large development of epidote and the latter garnet and diopside.

Geologists at 150 ft. Level Entrance to Hidden Creek Mine, B.C.

Tantalus Coal Mine.—A short time was also spent at the Tantalus coal mine, situated 155 miles above Dawson. This mine lies on the bank of the river, and the coal may be loaded directly on scows and shipped down stream to Dawson, where it is said to sell at about $12 to $15 per ton, although at times running considerably above or below these figures. The daily wage paid to all miners is $5 per day, this being that of the Klondike district. The coal is of Jura-Cretaceous age. It is a good quality of soft coal and the seams are of fair thickness.

The Klondike.

The Placer Deposits.—From Dawson City the party was driven up the Klondike River, Hunker Creek, over "The Dome," down Dominion Creek, up Sulphur Creek, across "The Dome," and down Bonanza Creek to the Klondike River. Probably the most surprising feature of the trip was the extent of the placers. It is estimated, and I believe on a fair basis, that there are 200 miles of gravel, in the district, with a pay streak an average of 200 feet in width. The great bulk of this gravel has either been worked over by the individual miner or it is low-grade, but it may be profitably hydraulicked or dredged.

The dredges.—The Boyle Concession Company is operating four dredges, two of which are said to be as large as any in the world. They were built at a cost of $480,000 each and they are capable of handling 11,000 cubic yards of gravel per day, at about 6 cents a yard, where the gravel is not frozen and of considerable thickness. Each dredge requires 1,005 electric horse-power for operation; it has 68 buckets, each weighing about two tons and holding 16.1 cubic feet of gravel. There are two shafts upon which it may be supported and rotated, each weighing 32 tons, and it is said it required 22 teams of horses to haul each of them from the wharf to the place where the dredge was assembled.

Thawing frozen ground.—The greatest obstacle to mining in the Klondike is the frozen ground, it being frozen to a maximum of approximately 200 feet, in restricted areas. Interbedded with the gravel is a bed of black muck varying in thickness from a few inches to 30 feet, and beneath this the gravel does not thaw. In the days of individual mining the miners sank a shaft through the muck and drifted beneath it, as it formed a satisfactory roof, but for dredging purposes the ground is either thawed by "steam points" or the muck is stripped from the gravel by means of a monitor and the gravel left to thaw by sun's heat. The Granville Mining Company considered that by the latter method the gravel could be prepared for dredging at a cost of about 2 cents per foot, while the former method costs usually from 10 to 17 cents per foot. The ground sluicing method makes the operator dependent upon the slow work of the sun, and since this method may be said to be in the experimental stage it seems probable that it will be found necessary to dredge off the thawed surface in order to permit the penetration of the heat to the lower levels.

Even at a cost of 10 to 17 cents per square foot for thawing and 6 cents per cubic foot for dredging a fair profit remains, since much of the gravel is said to average 30 cents a cubic yard.

During a visit to a property operated by an individual miner we entered a shaft 38 feet deep, in gravel frozen to bed rock. The operator stated that the values ran about 60 cents per square foot of pay streak, the latter on this property being less than one foot thick, and the expenses of mining averaged about 45 cents per foot. It is therefore evident that much of this gravel could be dredged at good profit.

I believe that Mr. H. M. Payne, who has investigated the mining operations of this district, believes the hot water system of thawing more efficient than the steam. He claims there is more loss of heat by conducting the steam under the necessary pressure than there is in transporting water, and that latent heat is wasted. It is true that heat may be lost in transferring the steam from the boiler to the points, but the latent heat is always available for thawing purposes, and the steam has the advantage of not forming so much excess water which stands in pools, and which in cold weather freezes near the place it is set free.

Bonanza Creek, Klondike. At Extreme Right is One of the Dredges of the Yukon Gold Co.

When first introduced the dredges only operated for a short period during the summer months, but with improved facilities for the prevention of freezing they expect soon to be able to operate, at least nine months of the year.

The gold production.—The output of gold this year is said to be around $5,000,000, and it would appear that this should continue nearly constant or even increase for some years. The Yukon Gold Company (the Guggenheim interests) has installed a hydraulicking system in which the water is conducted about 75 miles by ditch, flume and pipe, and used in working the extensive de-

posits of "White Channel" gravels on Bonanza Creek and elsewhere. This company also has a number of dredges in operation, and the Granville Mining Company, which has acquired large holdings on Dominion and Sulphur creeks, has only begun operations. The Boyle Concession Company estimates that with their annual capacity of about 7,000,000 cubic yards their holdings should contain a supply of workable gravel sufficient for 20 years. Only one quartz mine seems to be in operation, and from the small size of most of the veins, or the barrenness of the large ones, one cannot take a very hopeful view of the quartz mining problem, although no one could fail to sympathize with the prospector, who, on first investigation, thinks "The Dome" should carry the quartz veins which have supplied all these rich streams with gold. Practically all the rich streams head in this mountain, but the gold seems to have come from innumerable small veins of quartz, which almost everywhere cut the sericite schists.

From these observations there is reason to believe that Dawson City will for a long time remain an important distributing centre for mining operations in Central Yukon and Alaska.

It would not be just to close this account of the C8 excursion without expressing appreciation of the kindness and courtesy of the officers of the mines which were visited, the officers of the Congress, and of the work of the geologists who have worked in these distant and difficult fields, especially the splendid work of Mr. R. G. McConnell which was found to be accurate and thorough in detail as well as in the larger structures and principles.

CEMENT.

Materials used in the manufacture of cement in Canada include marls, limestones, clays and blast furnace slag. The occurrence of cement materials is so widespread and abundant in all parts of the country that the question of their utilization is largely economic, being dependent upon the market for the product, the comparative availability of suitable raw materials in different localities, the cost of fuel, and the transportation facilities.

There are at present 24 completed cement plants in Canada, with a total daily capacity of about 28,800 barrels, besides several plants in course of construction. The total production in 1912 was 7,132,732 barrels, valued at $9,106,556, and in addition 1,434,413 barrels were imported.

Hydraulicking the High Level "White Channel" Gravels on Property of the Yukon Gold Co., Bonanza Creek, Klondike

CORUNDUM.

In spite of the large increase in late years in the manufacture and consumption of artificial abrasives, such as carborundum, alundum, etc., natural corundum is still preferred for certain purposes, and the Canadian deposits of this mineral yield practically the entire supply. In 1912 the production amounted to 1,960 tons, valued at $239,091.

The corundum mines are situated in the eastern portion of the Province of Ontario, in the townships of Carlow and Raglan, and mining operations have been in progress since 1900. At present mining is being conducted solely by one corporation—the Manufacturers Corundum Company—who have acquired the mines and mills formerly operated by the Ontario Corundum Company, in Carlow, and the Canadian Corundum Company, in Raglan.

THE CHISANA (SHUSHANNA) GOLD DISTRICT*

By D. D. Cairnes.

Throughout a small area within Chisana district, Alaska, not exceeding 10 or 12 square miles in extent, rich gold-bearing gravels have been found, but what the adjoining territory may contain is as yet problematical. The geological formations and other general characteristics appear to persist, however, to the eastward well into Canadian territory, 30 to 40 miles distant, and it is quite possible that further valuable deposits of placer gold may be found within this belt, not only in Alaska but in Yukon as well. The district is difficult to reach and, due to the northern latitude, conditions are extremely severe on those not properly equipped or unaccustomed to the climatic and other conditions there prevailing.

The original discovery in Chisana district, generally known as the James discovery, is located 30 miles west of the International boundary line, at about latitude 62 degs. 10 mins. N. and longitude 141 degs. 55 mins. W. The gold-bearing belt lies along the southern edge of the Nutzotin mountains, and within 25 miles of the northern slopes of the snow and ice-capped Wrangell mountains which include several peaks exceeding 12,000 feet above sea-level, the highest of which—Mount Sanford—rises to a height of 16,200 feet above the sea. The Chisana gold deposits, situated as they are near the head waters of the White and Tanana rivers, are in a district which is very difficult to reach and may be considered one of the least accessible portions of Alaska.

Five main routes to Chisana are available, two of which may be considered as Alaskan, and the remaining three as Yukon routes. The two Alaskan routes are respectively by way of the Copper river and Northwestern Railway, and the Tanana river.

By the railway route, the railway is followed from tide water at Cordova to McCarty, a point near the northern end of the railway line, 191 miles from Cordova. Thence this route proceeds either over the Skolai or Chitistove passes to Russell glacier at the head of White river. The valley of White river is then generally followed to Solo creek, whence the trail proceeds northward to the gold fields. From McCarty to the James discovery is about 10 days' travel for pack horses, the route by the Chitistove pass being somewhat shorter but more dangerous than that by the Skolai pass. Either route is both difficult and dangerous, and is available only during a few weeks in the summer.

By the Tanana River route, the distance from Fairbanks to the mouth of Chathenda creek (also known as Johnson creek) which is a tributary of Chisana river, is about 350 miles. Over this part of the route it is claimed that small power boats will be able to reach within 50 or 75 miles of Chathenda creek. For the remaining portion of the 350 miles, poling boats may be employed. This route is very long, arduous, and difficult, and in any case will only be followed by persons already at Fairbanks or some nearby portion of central Alaska, it being altogether an impossible route for persons residing outside Alaska.

All three of the Canadian routes proceed from tidewater to Skagway, over the White Pass and Yukon Railway to Whitehorse, a distance of 110 miles. From Whitehorse, the routes diverge and may be named the Kluane, Coffee Creek, and White River routes, respectively.

The Kluane follows the wagon road from Whitehorse westward to the upper end of Lake Kluane, a distance of 143 miles, and proceeds thence by trail via Canyon City to Chisana, a distance of 170 miles. In winter the route from Kluane to Canyon City is shortened about 25 miles due to the fact that it is possible to travel from the upper end of Lake Kluane practically the entire length of the lake on the ice, instead of having to follow around the southern end and western side of the lake. From Lake Kluane to Canyon City, no trail has as yet been constructed, although one will in all probability soon be built. Quite a number of persons have travelled this route, however, although to those unacquainted with the district the portion of the journey from Lake Kluane to Canyon City is somewhat difficult. From Canyon City to Chisana, the route is well defined, and for part of the distance a good trail has been constructed.

By the Coffee Creek route, Lewes and Yukon rivers are followed from Whitehorse to the mouth of Coffee creek on Yukon river. Coffee creek is 350 miles from Whitehorse, and 110 miles from Dawson by river. Commodious steamers ply regularly between Whitehorse and Dawson during the summer months, it being now possible to catch a steamer going either up or down stream almost any day during the season. From Coffee creek a good government trail has been constructed to Canyon City, and a branch of this trail is being constructed to the mouth of Snag creek on White river, distances from Coffee creek of 120 and 95 miles respectively. The distances from Canyon City and Snag creek to the discovery are 50 and 75 miles, respectively. Government trails have been constructed from Snag creek and Canyon City westward to the international boundary or to within about 35 miles of the James discovery. The trip from Coffee creek to the James discovery via Canyon City can be made with pack horses in summer in 10 or 11 days, without unduly exercising the pack animals.

The White River route follows up White river from its mouth to Snag creek, a distance of 115 miles, and thence the trail to the gold fields is followed a further distance of 75 miles. The mouth of White river is 381 miles from Whitehorse, and 80 miles from Dawson by river. White river is navigable for power craft for about 90 miles from the mouth, and one especially designed gasoline boat is reported to have reached Snag creek in four days, from the mouth of the river.

The three Canadian routes are all available throughout the entire year, but travelling and freighting is much easier, quicker, and cheaper in winter when sleds may be employed, than in summer when it is customary to use poling boats or pack horses, except in cases where men pack on their own backs or pack by dogs. It is difficult to say which of the three Canadian routes is best. Special circumstances will decide in each case.

But little was known concerning the particular locality in which the Chisana gold-bearing gravels have been discovered, until this past summer, but geological work had been performed in adjoining territory on practically all sides of the district. Between 1891 and 1902, C. W. Hayes, Alfred H. Brooks, Oscar Rohn,

*From a report made by Dr. Cairnes to the Geological Survey.

Frank S. Schrader, and others, made reconnaissance surveys in adjoining portions of Alaska and Yukon. During the summers of 1904 and 1905, R. G. McConnell, of the Canadian Geological Survey, explored the Kluane district and the territory along certain of the headwater tributaries of White river. In 1908, Messrs. Moffit and Knopf, of the United States Geological Survey, mapped and explored the Nabesna-White River district immediately adjoining the Chisana. Thus, although no detailed information concerning this exact area was available previous to the time of the strike, a great amount of general information was available and the adjoining district on the Canadian side of the boundary line had been considered for some years to be one of exceptional promise, and would have already been investigated, geologically, except for a series of unavoidable delays. The writer was accordingly appointed to investigate the adjoining White River district during the past season, and reached there before the stampede commenced. The directors of the Canadian and United States Geological Surveys at Ottawa and Washington respectively, are forwarding all the information that is available concerning Chisana and the adjoining districts to all requesting such.

Chisana district, along the east side of Chisana river, and the creeks in which the gold has been found, are tributary to this stream which has given the district its name. The name Chisana appears in all the older authentic maps published by the various United States government departments and the name "Shushanna" which has recently appeared in the press so frequently, is merely a corruption of Chisana. All records filed in the district and all authentic documents spell the name C-h-i-s-a-n-a.

The district is mountainous, but immediately adjoining the gold-bearing creeks is not rugged, being characteristically undulatory in character. The mountains immediately to the north, however, in which these creeks head, are quite rugged and rise to elevations of 9,000 to 10,000 feet above sea-level, the James discovery being about 5,000 feet above the sea. All the higher elevations including the main gold-bearing creeks, are above timber line, the closest timber being along the valley bottom of Chathenda creek distant 3 or 4 miles from the James discovery.

The geological formation is dominantly sedimentary, and consists of dark grey to black shales and slates which are extensively invaded by basic volcanics which occur prevailingly in the form of dykes less than 100 feet in thickness. The strata of the prominent, easterly-trending range in which the gold-bearing creeks head, and which are undoubtedly the source of the placer gold, have been very highly mineralized as a result of this igneous invasion and have a general bright red appearance throughout, due to leaching and oxidation of the contained iron-ore minerals.

No evidence of glaciation was detected in the district, which partly accounts for the presence of the gold. Had the district been glaciated, the water-sorted accumulations of gold in the gravels would have become scattered through enormous masses of unsorted material and would thus have been lost.

Gold is believed to have been first discovered in Chisana district about May 3, 1913, by William E. James and Peter Nelson, of Dawson, both of whom with a third partner, Frederick Best, had spent the previous winter prospecting in White River district. A story is current to the effect that an Indian named "Joe" first found the gold and told James of the discovery. Mr. James has denied this, stating that all the Indian showed him was a quartz vein on Chathenda creek which contained free gold, and that he later found the placer gold himself. The partners, James and Nelson, commenced sluicing on Discovery claim on Little Eldorado creek on July 4 and by August 2 had obtained about $9,000 from this claim, an average of about $300 per man for each 8 hours of work performed. It had been impossible up to that time to employ men in the district, and the work performed had practically all been done by the owners who, in addition, had to devote a considerable portion of their time to looking after other extensive interests in the vicinity. When the writer left the district on August 4, Discovery claim on Little Eldorado was the only claim from which any considerable amount of gold had been obtained. Since that time, however, from information obtained from what are thought to be quite reliable sources, it appears that a number of other properties have become important producers.

The creek gravels are not frozen in summer, as they are not covered by muck or moss, but the bench gravels are frozen in most places throughout the entire year. A number of the present streams have comparatively recently formed canyon-like valleys, and in places the material of the older stream channels is quite apparent and the gravels they contain constitute the main bench gravels of the district. From these gravels it is possible the bulk of the gold will be obtained, either from the old channels themselves directly, or from the present stream channels where these cut the older gravels. In such places the gold originally in the older gravels is now concentrated in the gravels of the present intersecting streams.

The creek gravels are very easily worked, being in most places less than 4 feet in thickness, and not over 100 feet in width, and they constitute typical prospectors' diggings, as a minimum of equipment, time, and labour are required to obtain the gold.

A small area not exceeding 12 square miles is known to contain important deposits of placer gold, but what the surrounding country may contain is as yet problematical. Recently a strike was made at the mouth of Chathenda creek which is reported to be rich; if so, this discovery adds considerably to the area known to be valuable. The geological formation and general conditions persist eastward well into Canadian territory 30 to 50 miles distant, and it is hoped that the gravels there may also prove to be rich in gold. In fact, Messrs. James, Nelson, and Best claim they found pay in Frying Pan creek in Yukon territory in the course of their operations last winter, but say they were forced to stop work as the water came in so rapidly in each case when they reached bedrock, that the pits or shafts had to be abandoned.

Several thousand men went into Chisana district this summer before the freeze-up, but with rare exceptions they were prepared to remain only a few days and departed, so that possibly at no one time were there more than 300 to 400 persons in the vicinity. Quite a number have now returned to the district with large outfits and are prepared to spend the winter prospecting and getting ready for work in the spring. A considerable number of cabins are being built, a post office and mail service is being established, and negotiations are under way for installing wireless telegraphy in the new camp. Royal Northwest Mounted Police have been stationed along the Canadian routes, and roadhouses have been built or are being built on White river at its mouth, at the mouth of Donjek river, and at the mouth of Snag creek. The Customs authorities

of both the United States and Canada have also mutually agreed to waive the duty on all goods going into Chisana district from either country for a period of one year. It is expected by spring, therefore, that there will be plenty of provisions and ordinary outfits available in the camp, although prices will naturally be high. All provisions have been worth at least one dollar per pound all season anywhere in the vicinity of Chisana district.

Since early in August, repeated warnings to prospectors and others have been made in the press, against going into this district this fall without good outfits, and otherwise being prepared to spend the winter in the field if necessary. Practically all the known valuable ground was located by August 1, since when there was no possibility of being able to stampede into the district, locate quickly, and return. All persons going into Chisana since August 1 should be prepared to do bona fide prospecting, and persons so prepared are quite liable to make important discoveries quite outside the area at present considered valuable.

Already a number of men have lost their lives during the stampede. Some were drowned in the dangerous rivers of that northern country, some met with fatal accidents crossing the Skolai or Chitistone passes, and others became lost and starved to death. Practically all the fatalities would have been avoided if all those going into the district had been properly outfitted.

THE METAL COBALT AND ITS ALLOYS

By H. T. Kalmus

(Continued from December 15 issue.)

Tensile Strength and Compressive Strength of Metallic Cobalt.

For each of these determinations the extensibility or ultimate elongation has been measured.

The numerical values for tensile and compressive strength of the pure metal cobalt have as yet not been determined to the same degree of accuracy as they have been for certain of the cobalt alloys. About 5 pounds of metallic cobalt is reduced from the oxide at a time, and a set of observations of the properties of the pure metal made with it. Then it is alloyed with a small percentage of aluminium, chromium, iron, etc., as the case may be, and a series of alloys made and studied with increasing content of the second metal. In this way each batch of cobalt yields a large number of sets of measurements of the properties of its alloys, with but a singular set for the pure metal.

The mean of 15 compression and tensile strength measurements shows these constants for pure cast cobalt to be extremely high. Until a complete publication of these data is made no specific figures will be given, but it is not improbable from the work thus far that the tensile and compressive strengths of pure cast cobalt are higher than the corresponding strengths of any of the ordinary pure metals.

As far as possible strength tests will ultimately be made on rolled and drawn pieces as well as on castings, both for the pure metals and for the alloys.

Electroplating Metallic Cobalt.

A series of experiments was performed on the electro-deposition of metallic cobalt to compare it with that of nickel. A variety of electrolytes were used and the effect of varying current densities and electromotive-forces studied. In a general way cobalt may be plated from an alkaline solution in very much the same way that nickel is commonly plated. A current density of 15 milliamperes per square centimetre, or lower, gives a brighter and more uniform deposit than current densities higher than this value.

In general it may be said from the results thus far obtained that cobalt may readily be plated, yielding a surface very similar to that of nickel, but somewhat tougher, more silvery in appearance, and more noncorrosive. We have plated nickel-cobalt alloys which appear to be extremely tough and which, therefore, are of commercial interest to the electrotyper. The writer has considered this matter carefully with some of the large electroplating concerns, and arrangements are being made to have tests made on a commercial basis.

Cobalt Chromium Alloys.

Certain alloys of cobalt and chromium are known to be extremely hard and certain of them to be extremely acid resisting. About 20 cobalt chromium alloys were prepared in an electric crucible furnace of the carbon plate resistor type. This furnace could be maintained at any temperature from 1,000° C. to 1,800° C. and absorbs up to 25 KW. Weighed amounts of cobalt and chromium were charged into the furnace in a graphite crucible lined with alundum cement. After the metals were melted and well mixed, these alloys were allowed to soak for about one-half hour at a temperature of 50° to 100° C. above their melting point. From this temperature the melts were poured both into sand and iron moulds. In general the lower the temperature of pouring above the melting point the freer the alloy from occluded gases. Neither skim gates nor risers were found to be necessary with these cobalt-chromium alloys, and sound bars 1 foot in length and 1 square inch in section were readily cast, using a very little manganese as a degasifier.

While the alloys of this series thus far made and tested are not as good as those being made at present, so that it is early to draw definite conclusions, nevertheless, the indications are that these alloys will suffer from their lack of ability to yield to heat treatment. The tools thus far made compare favourably with the best untreated tool steels, but as yet they do not lend themselves to heat treatment and do not compare favourably with the best tempered tools or with good self-hardening steels.

Aluminum-Cobalt Alloys, and Aluminum-Cobalt-Copper Alloys.

In discussing the requirements of the market with some of the larger foundrymen, the writer has repeatedly had it emphasized to him that there is an urgent need in many quarters, particularly among automobile manufacturers, of an alloy of aluminum which shall not be very much heavier than the present alloys

largely used, but which shall have increased tensile strength, and which shall not be subject to the same degree of shrinkage in casting.

I note 53 alloys of aluminum, principally copper-aluminum alloys, which are at present in use; easily 90 per cent. of all the castings of this series used in automobile construction are of the composition aluminum 92 per cent., copper 8 per cent. This particular alloy has a tensile strength of about 20,000 pounds per square inch, and shrinks badly in casting.

The tensile strength of the light casting alloys of aluminum is tremendously influenced by the size of the constituent crystals, that is, "by the closeness of the grain." For any given composition the finer the grain that can be produced the stronger the metal. The closeness of the grain of these alloys is greatly affected by: (a) Small additions of other elements. (b) The volume and dimensions of the casting. (c) The temperature and heat conductivity of the mould. (d) The temperature at which the metal is poured into the mould.

The extreme industrial importance of these alloys, as well as the fact that certain preliminary experiments made it appear that satisfactory results might be expected, has caused us to undertake the investigation of the effect of adding various proportions of cobalt to aluminum and to copper-aluminum alloys. Since commencing this work a German patent, by W. Borchers and Herman Schirmeister, Aachen, which was issued in January, 1912, has come to hand. We are finding, in keeping with this patent, that additions of from 8-10 per cent. of cobalt, and in the neighbourhood of 1 per cent. of tungsten or of molybdenum, yield alloys which are more readily worked and finished, and which are more non-corrosive than pure aluminum.

Beyond this patent there seems to be nothing in the literature pertaining to this series, but, in any event, the factors which determine the ultimate valuable properties of such an alloy are so numerous that there is offered a most promising field for a great variety of investigations.

Starting with pure aluminum, alloys are being prepared with increasing percentages of cobalt, and as well, a great variety of aluminum cobalt-copper alloys are being cast and studied. The effect of both tungsten and molybdenum in small percentages is also being tried. Determinations are being made under the various headings enumerated under cobalt-chromium alloys.

Great difficulty has been experienced in obtaining these castings free from occluded gases, and it is only during the last weeks, after pouring some 100 castings, that the technique has become sufficiently well in hand to promise representative results. Consequently a report of the numerical constants of this series will be deferred until later, at which time the entire series will be treated in an independent publication.

Non-corrosive Alloys.

Apart from the cobalt-chromium alloys, the acid resisting properties of which have already been noted under the heading "Cobalt-Chromium Alloys," there are certain cobalt-tin alloys and cobalt-copper-tin alloys which are extremely passive. Alloys containing 80 per cent. to 95 per cent. copper, 12 per cent. to 3 per cent. tin, 8 per cent. to 2 per cent. cobalt, have been and are being prepared, and passivity tests made.

During the progress of the experiments on cobalt-tin alloys, a paper has come to my attention entitled "Die Erhohung der chemischen Widerstandsfahigheit mechanisch noch gut bearbeitbarer, fur Konstruktionszwecke verwendbarer Legierungen," by Otto Barth, Metallurgie 1912, page 216, in which the author discusses alloys containing cobalt and tin in the ratio of 4 to 6 as being particularly non-corrosive. The series of cobalt-copper-tin alloys with small additions of other elements are being studied in some detail. The alloy 40 per cent. Co and 60 per cent. Sn, without further addition, was prepared and found to be practically insoluble in all concentrations of nitric acid. However, this particular alloy is so brittle that it is worthless for most purposes. We are experimenting to better the working properties of this alloy without too greatly diminishing its passivity.

The writer has had a number of inquiries from prominent chemists and engineers with regard to these non-corrosive alloys, and a study of their properties in chemical reagents other than acids is being planned.

Magnetic Alloys.

One of the first matters considered upon the establishment of this laboratory was the possibility of preparing alloys of cobalt and iron which should have a greater magnetic permeability than the best iron now in use for electromagnetic apparatus. The discovery of such an alloy, having working properties capable of rendering its use possible, either for the construction of electro-magnetic machinery or of small measuring instruments, would, of course, be of tremendous importance.

Our experiments indicate that the alloy of such proportions as to yield the compound FE_2Co, has a magnetic permeability about 10 per cent. greater than that of the best magnetic soft iron. Due to the difficulties of obtaining a suitable pure iron for experimenal purposes, and due to delays in obtaining certain auxiliary apparatus, fuller observations on these cobalt-iron magnetic alloys, such as to establish their permeability, have not yet been made. This work will be completed in the near future, and a corresponding independent publication made.

From Atlin comes information of expectations of a much higher total value of gold produced in 1913 than in any other year since 1907. The returns will include lode as well as placer gold.

In Nelson division, among others the Silver King and Molly Gibson mines, both operated by the Consolidated Mining and Smelting Co., are making a good showing. News from Ymir tells of improved conditions at both the Dundee and Yankee Girl mines.

The British Columbia Copper Co. is continuing its activities in several camps in Boundary and Similkameen districts, and reports published tell of substantially large deposits of ore opened by development work of this year.

Additions being made to plant at the Iron Mask mine, near Kamloops, include electric motors, generators, etc. The electric current will be transmitted over a line from the power station of the City of Kamloops, the intention being to use electric power for driving most of the machinery.

In Portland Canal district, excellent progress has been made in driving the long adit of the Portland Canal Tunnels, Ltd. At about 2,300 ft. in the rock being passed through is freely mineralized, and indications of ore not far ahead are stated to be favourable.

OXYGEN BREATHING APPARATUS

The Controversy of the Injector vs. the Non-Injector Types.

By F. W. Gray.

English and French mining literature has contained much within the past twelve months, having to do with the comparative merits of oxygen breathing apparatus of the injector type and those of the non-injector type. Particular interest has been taken in what has practically amounted to a controversy since Dr. Cadman reported on the death of Mr. Painter at Caeduke Colliery, who succumbed while wearing a Draeger apparatus in irrespirable air. Dr. Cadman found two minute punctures in the regenerator cartridge, and gave his opinion that death was due to carbon monoxide being sucked into the circulating air of the apparatus from the outside. Dr. Cadman further expressed the opinion that an injector apparatus, possessing as it does a zone of negative pressure, "Is always liable to leakage and it would be in the interests of safety if the apparatus were made to give positive pressure only, so that any small leaks which must inevitably occur, will pass gas from the inside to the outside of the apparatus."

Dr. Forstmann's Paper Reassuring—As Dr. Cadman's strictures cast grave reflections upon the safety of breathing apparatus of the injector type, and as a preponderatingly great proportion of the breathing apparatus actually in use is of this type, particularly in Germany, Austria and in North America, any record of authoritative tests bearing directly upon the controverted points is of interest. In the issue of "Gluckauf" of 27th September last there were published two papers read before the Second International Congress on Rescue Work and the Prevention of Accidents, which was convened at Vienna this year. A full translation of one of these papers, that written by Dr. Forstmann, is published in this issue of the "Journal," and contains information that will reassure the users of injector-type apparatus. The second paper, by Bergassessor Grahn, a recognized authority on breathing apparatus, states that the manufacturers of the standard German types of breathing apparatus—"with a view to removing all possible objections to the use of injectors in rescue apparatus arising out of the possibility of poisonous gas being drawn in by suction originating from negative pressure inside the apparatus, had adopted means to ensure positive pressure throughout the apparatus."

Apparatus Should be Tested.—It would seem from Dr. Forstmann's experiments, that too great importance has been laid upon the possible dangers of leaks, either in apparatus of the injector or the non-injector type. An apparatus with a leak, no matter how infinitesimal, is a defective apparatus, and it is not clear why Dr. Cadman should consider that small leaks "must inevitably occur." Dr. Forstmann contends that before a leak can become dangerous it must be of a diameter that could not escape detection by proper testing, and there lies the whole point of the matter.

Every modern standard oxygen breathing apparatus on the market to-day is an example of ingenious mechanism. Ignoring in this particular consideration the liquid-air apparatus, all the accepted breathing apparatus of to-day use compressed oxygen, in conjunction with alkali regenerators for the elimination of carbon-dioxide, and they vary but in details of design. It may be said that as mechanical devices they approach perfection. It is to the chemist that we must look for radical improvements in the future breathing apparatus rather than to the mechanic. Breathing apparatus of the types now on the market have done good work, have enabled things to be done which before their advent would have been impossible, and which even to-day are not sufficiently apprehended or appreciated. But these same apparatus, as before emphasized, are mechanical devices depending on nice adjustments. They must be used with care and judgment, and with a due appreciation of their limitations as well as their possibilities. The sportsman who hunts big game sees that his guns and cartridges are in good order, the aviator does not attempt flight until he has looked to his flying machine, nor the diver descend until he has inspected his diving suit and appliances. In like manner the wearer of a breathing apparatus in irrespirable gases knows that his life depends upon the efficiency of that apparatus, and it should not be used without previous testing. Nothing is so likely to bring breathing apparatus into disrepute as the idea that they can be stored for months and years, and then brought out and used, sometimes by inexperienced men. No mechanical device yet invented will allow of such treatment, and in this respect breathing apparatus is not different from a watch, a gun or a motor car. This point has not been sufficiently recognized by makers of apparatus, nor by paternal governments. Makers of apparatus have oftentimes been more anxious to sell their goods, or to criticize those of their rivals, than to point out the dangers of improper use; and governments have enacted laws making the provision of breathing apparatus compulsory, forgetting sometimes, it is to be feared, the necessity for the subsequent inspection and care of the prescribed apparatus. Breathing apparatus should be in the charge of a competent skilled instructor, who should inspect and test all apparatus before use. In passing, it may be remarked that the instructor should not wear the apparatus himself, nor place himself in a position of danger, but should remain at the base to see that his men are properly equipped. If it is not considered possible to have a competent man to take charge of breathing apparatus it is far better to be without them. No person should be allowed to use a breathing apparatus under dangerous conditions underground—no matter if he be an official—unless he has had proper practice in its use, and is thoroughly acquainted with the mechanism of the apparatus. It is time that mine owners and governments realized that the use of breathing apparatus under dangerous conditions is work for a specialist, and not for the untrained man, even though the untrained user be a man of position and intelligence.

An inspection of the apparatus now installed at stations in America, and maybe elsewhere, would reveal that a great deal of the equipment is defective. The apparatus are probably stored in a hot and arid place, exposed to sunlight and great alternations of temperature, attended to by incompetent persons, or entirely neglected, and when required for use, more likely to prove a danger than a help.

In commenting on the possibilities of leaks, Dr. Forstmann pertinently remarks: "Of course, where appar-

atus is not kept in good order, and if the proper tests are not applied before use, the life of the wearer may be placed in danger. In such a case, however, there are **many other possibilities of danger, at least as important.**

One cannot help thinking that a great deal that has been said and written in the controversy on injector types versus non-injector types has been influenced by the bias of the makers and users of the rival methods, and that the importance of this point has been overstated. But what has not been overstated, and may have been deliberately concealed is that breathing apparatus require expert care and attention before use, and trained men to use them. If these conditions were always fulfilled we should hear less of leaks and of fatalities among the users of breathing apparatus.

Chief Use is to Fight Fire.—A point in Dr. Forstmann's article is his evident understanding that the chief service of breathing apparatus is in the fighting of mine fires. As an able editorial in the "Colliery Guardian"—reprinted in this Journal—recently pointed out all the recent disastrous explosions in coal mines have been accompanied by outbreaks of fire—the Senghenydd explosion being the last example—and the use of breathing apparatus in combatting fire underground is a going back to first principles. German mining engineers were among the first to see the advantages of self-contained oxygen breathing apparatus in subduing underground fires, and the idea of using them for saving human life was not prominently brought before the public eye until the spectacular journey of the Shamrock Rescue Corps from Herne in Westphalia to Courrieres, after the explosion that took such an unexampled toll of life. The use of the word "rescue" in connection with breathing apparatus is largely a misnomer, and is responsible for much misunderstanding of the true functions of these devices.

To Sum Up.—Breathing apparatus are an essential part of the equipment of every modern colliery, and have in many instances proved themselves to be of great utility, but, like every other part of mine equipment, they must receive proper care and inspection, must be taken seriously and not regarded as a rare show or a fad, and must be used under the same discipline and with the same sense of responsibility, as say, the ventilating fan, or the man-hoisting shaft.

OXYGEN BREATHING APPARATUS WITH AND WITHOUT INJECTORS*

By Bergassessor Dr. Ing. Forstmann, of Essen.

(Translated by F. W. Gray, from "Glückauf," Sept. 27, 1913.)

At a meeting of the South Staffordshire & Warwickshire Institute of Mining Engineers, held December 16th, 1912, Professor Cadman, of the University of Birmingham, pointed out that in breathing apparatus using injectors negative pressure existed, and consequently, if leaks were present, the outer atmosphere might gain admission. In his opinion this presented a source of danger to the wearer of such breathing apparatus, and made it neeessary to replace all injector breathing apparatus by apparatus without injectors. This expression of opinion has led to a lively exchange of views in the English and French technical periodicals, and a eloser examination of the question appears desirable.

The injector in breathing apparatus was introduced in 1901 by Fire Director Giersberg. Its chief advantages are the following:

The air in the apparatus circulates of itself—without lung movement—thereby sparing the lungs, and increasing the working capacity of the wearer. With the automatic air circulation the addition of regenerator cartridges beeame possible and more perfect elimination of CO_2, whieh again favourably influenced the capacity of the wearer for work.

It may properly be urged that the injector by setting up a negative pressure in the apparatus might induee the entrance of outer air through leaks. This possibility was not considered as of a serious nature, and was outweighed by the considerable advantages of the injector. It was also found possible, shortly after the introduction of the injector, to obtain a better testing of the whole apparatus by the use of the depression meter. Moreover, it was believed that a danger whieh presented itself only occasionally might best be met by exercising the greatest care to have apparatus in good condition, and by a thorough instruction and education of the reseue corps.

Since 1901 thousands of apparatus have been manufactured with injeetors, and used in actual practice, without, up to the present any confirmation of Professor Cadman's fears.

Figures 1 to 4 are diagrammatic sketches of the types of apparatus now in use and manufactured by the Draeger and the Westfalia Companies.

In a few types of apparatus (Fleuss, Tissot) using oxygen, the injector is not employed. As an example of such an apparatus, Fig. 5 gives the scheme of the newest model of the Fleuss apparatus, manufactured by Siebe Gorman & Co., which possesses great resemblance to the old Shamrock type.

Although the objections which Professor Cadman has urged against the injector have been long recognized in Germany and Austria, and not regarded as being fatal, yet his disenssion of the matter, has led me to make further researches.

The first question that arises is what extent of ineoming outer air is dangerous to the wearer of a breathing apparatus. Aceording to the figures given by several authorities the inhalation of 1.1 litres of carbon-monoxide is sufficient to fully saturate the blood, causing death, and uneonseiousness supervenes after inhalation of 0.55 litres. From numerous experiments carried out by the Berggewerkschaftskasse in Bochum it has been established that the highest percentage of carbon-monoxide noticed in fire-gases is 0.6 per cent. In the voluminous researches undertaken in Upper Silesia fire-gases were found to contain 0.1-1 per cent. carbon-monoxide, and only in exceptional cases was the greater

*A paper read before Section VI. of the Second International Congress on Rescue Work and the Prevention of Accidents, held in Vienna, 1913.

proportion of 3 per cent. observed. Similar results have been published in Austrian papers. When over 1 per cent. of monoxide is present the case falls under the category of gases escaping from a sealed-off fire area.

From these numerous observations it may be deduced

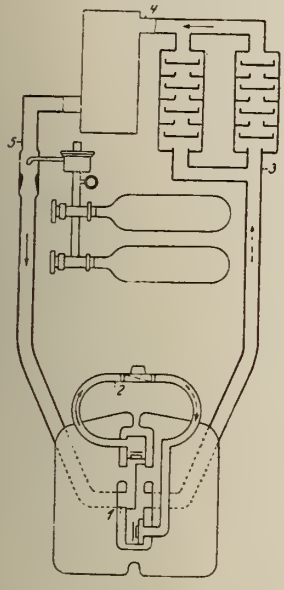


Fig. No. 1—Draeger Apparatus, Model 1904-09.

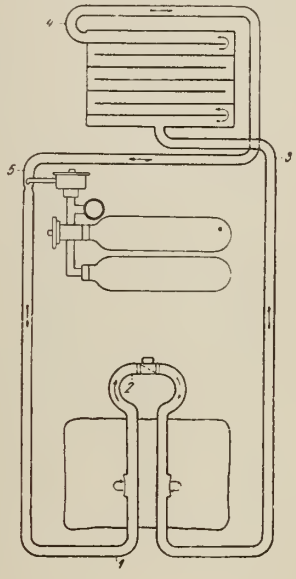


Fig. No. 2—Westfalia Apparatus, Model 1908

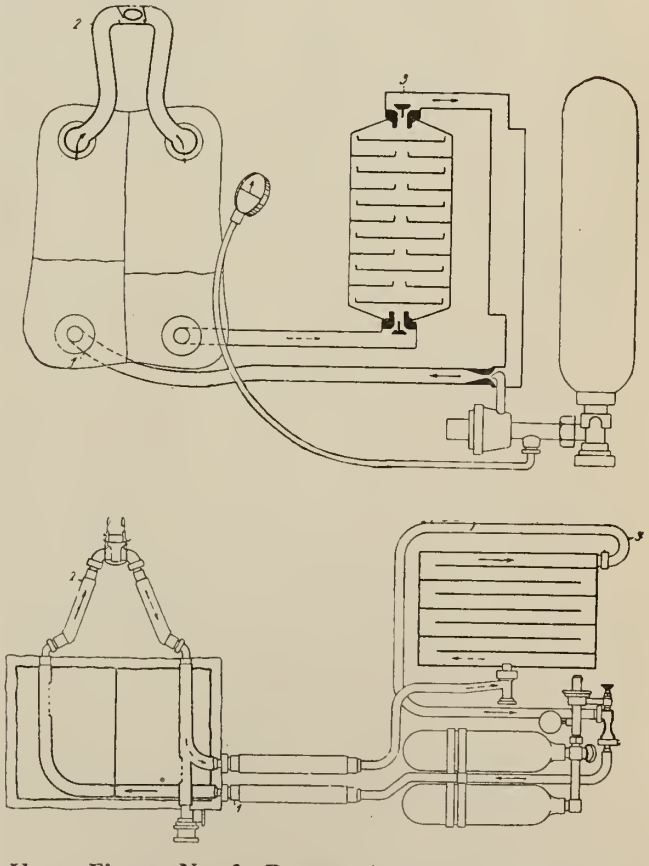
that in actual practice in fire-fighting and rescue work not more than 1 per cent. of monoxide will be encountered. (Professor Cadman always reckons on a monoxide percentage of 5 per cent.) If the fire-gases contain 1 per cent. monoxide, with a leak in the apparatus allowing the entrance of ½ litre of the outer air in one minute, then in two hours sufficient monoxide will have entered the apparatus to overcome the wearer. If the leak is larger than this, unconsciousness will, of course, follow more rapidly. With a smaller percentage of monoxide the danger is naturally less. The question, therefore is, how large must the leak be to admit so much of the outer air, and can such a leak remain unnoticed?

Professor Cadman does not give details of his experiments. He seems to have reckoned the volume of the incoming outer air from the extent of the negative pressure existing in the apparatus. But, as every test shows, the pressure in an apparatus in use varies constantly. It does not depend on whether the wearer breathes in or out, but on how strongly he breathes. Therefore every reading is inexact, and one can name almost any figure. As, moreover, first negative and then positive pressure rules, the volume of air actually entering cannot be decided in this way.

In order to obtain accurate results I had made for the experiments a small volume meter (see Fig. 6) holding about five litres. To eliminate frictional resistances as far as possible the pulley from which the bell and counterweight is supended was strongly constructed and provided with ball bearings. This made it possible to balance the bell so nicely that it sank on the least emission of air. A table of weights was used during the experiments which showed the correct weight of the bell in every position, the weight being thereby completely eliminated from the calculations. Small pieces of lead, weighing about 10 g. were employed, and according as the bell sank, they were removed from the counterweight. The connecting tubes between the meter and the apparatus under test holder was so delicately adjusted that it responded to the least alteration of pressure.

A number of points were selected for testing the several types of apparatus, the order being as shown in Figs. 1 to 4. In the older types of the Draeger and Westfalia apparatus five points were selected, in the newer types three points, and in the Fleuss apparatus two points only were chosen. In the four injector types the measuring points are numbered consecutively in the direction of the air circulation, commencing from the injector. The two first points lie between the injector and the mouth, therefore in a part of the air passage in which the injector acts as a blower, so that positive pressure must exist here. The other parts are in the region of suction, or negative pressure. In the two old types (Figs. 1 and 2) three points were chosen in the negative zone (Points 3-5) and in the newer types (Figs. 3 and 4) only one point (3), was taken, this last-named point (3) corresponding to point 4 in the older types. Points 3 and 5 in the older types can be neglected as at 3 only a little air is under negative pressure and the suction at 5 does not materially vary from that at 4.

In the Fleuss apparatus (Fig. 5) point 1 lies between the breathing bag and the inhalation valve, and point 2 between the valve and the mouth.



Upper Figure, No. 3—Draeger Apparatus, Model 1911
Lower Figure, No. 4—Westfalia Apparatus, Model 1912.

In order to experiment with openings of varying size, short connecting pieces with circular openings of 5, 2 and 1 mm. were used. Measurements were taken with apparatus at work and at rest. The last-named trials were not difficult and were, as a rule, extended over four minutes in order to obtain a reliable average.

The measurements during work were more difficult to obtain. After several futile trials a continuous run was chosen as the only possibility. This had the advantage of giving a more uniform effort, and a stronger one, than exercise at the usual apparatus for measuring work performance. At first it was attempted to extend the run over two minutes. This proved rather too strenuous for the persons under test, and the run was usually limited to a duration of one and a half minutes. The experiments were conducted on three persons, in one case on two persons, and were invariably repeated in order to obtain a reliable average.

Preliminary experiments with the depression meter had established that the negative pressure existing in breathing apparatus when worn by different persons varied somewhat. Also a great deal depends on whether the breathing bag is filled with air or not. The setting of the blow-off or release valve, and, in a lesser degree, the depression of the injector, were influencing factors, and had much to do with determining the volume of incoming air through a given leak. However, the experiments with

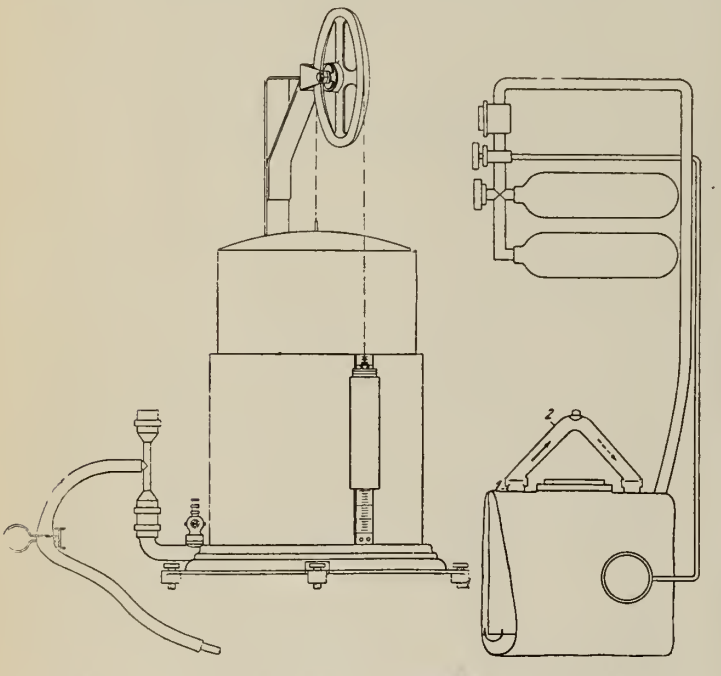


Fig 6—Air Volume Meter.

Fig. 5—Fleuss Apparatus.

an empty breathing bag were of no value, as in actual practice such a case is not met. The depression of the injector and the setting of the release valve must, however, be taken into consideration. The result of the tests is given in the tables attached.

The results of experiments dealing with the effect of various high depressions of the injector are not given in the tables. They were useless, as the air volume was sometimes greater with the highest depression, and sometimes greater with the lowest depression. The reason for this may be, that an alteration of the depression is followed by an alteration of the volume of the circulating air in the apparatus, and a difference in the depression of 225 mm.—measurements were made at 90 and 115 mm.—was not able to exercise any appreciable effect.

Table 1 illustrates the effect of the adjustment of the release valve. Settings of 16 and 36 mm. were selected. The results showed plainly that with a low set release valve considerably more outer air obtained entrance.

TABLE 1.—Effect of the Setting of the Blow-off Valve on the Volume of Air Entering From Outside.

Depression of the Injector 115 Millimetres. Leak of 5 Millimetres.

Point on apparatus where test was taken Fig. 2.	Person Exercising.	Volume of air entering in one minute. Resting. Blow-off Valve. 16 mm.	36 mm.	After Run. 16 mm.	36 mm.
1	A	...	...	...	...
		...	...	...	...
	B	...	...	0.10	...
		...	...	...	...
	C	...	...	0.10	...
		...	...	...	...
2	A	...	...	0.67	0.26
		...	...	0.80	...
	B	...	...	1.00	0.67
		...	...	1.13	0.40
	C	...	...	1.40	1.06
		...	...	1.40	0.86
3	A	...	0.06	1.46	0.86
		0.06	...	1.40	1.53
	B	...	...	3.00	1.67
		...	...	2.27	1.73
	C	0.06	...	3.00	2.06
		0.05	...	2.60	1.80
4	A	0.70	0.06	2.00	2.00
		1.07	0.50	2.26	1.73
	B	0.26	...	3.66	2.73
		0.73	...	3.90	3.20
	C	1.33	0.20	3.80	2.40
		0.77	0.20	3.60	2.47
5	A	1.65	0.52	1.80	1.86
		1.00	0.37	2.00	1.40
	B	1.13	0.20	3.52	2.73
		1.66	0.07	3.52	3.90
	C	1.60	0.90	3.00	1.73
		1.40	0.92	3.60	2.67

The results given in this Table will not bear comparison with the more extended tests, as they were merely preliminary, and not carried out under the same conditions as the chief tests. In the preliminary tests no valve was provided on the holder of the volumemeter.

TABLE 2.—Westfalia Apparatus—Model 1908. Air Entering per Minute.

Depression of the Injector 115 Millimetres. Setting of the Blow-off Valve 36 Millimetres.

Point on apparatus where test was taken (Fig 2).	Person Exercising	Resting. Size of Leak. 5 mm.	2 mm.	1 mm.	After Run. 5 mm.	2 mm.	1 mm.
1	A	0.23	...	...	0.33	...	...
		0.35	...	...	0.33	...	...
	B	...	...	...	0.33	...	...
		...	...	...	0.33	...	...
	C	...	...	...	0.60	...	...
		0.10	...	...	0.40	...	...
2	A	0.10	...	...	2.66	...	...
		1.40	...	...	2.86	...	...
	B	1.17	...	...	2.86	...	...
		1.30	...	...	3.51	0.10	...
	C	0.57	...	...	2.53	0.40	...
		0.70	...	...	2.53	0.26	...
3	A	0.21	...	...	2.00	0.10	...
		1.46	...	...	2.00	0.13	...
	B	1.26	...	...	2.67	0.26	...
		1.60	...	...	3.51	0.36	...
	C	1.35	...	...	2.53	0.30	...
		1.76	...	...	2.13	0.33	...
4	A	0.73	...	...	2.40	0.26	0.16
		1.60	...	...	2.40	0.40	0.10
	B	1.26	...	...	3.15	0.53	0.16
		1.60	...	...	3.52	0.63	0.20
	C	1.46	...	...	2.93	0.46	0.03
		1.76	0.16	...	3.52	0.46	0.03
5	A	0.90	...	...	2.80	0.33	0.06
		1.17	...	...	2.66	0.46	0.10
	B	1.35	0.12	...	3.15	0.60	0.16
		2.10	0.10	...	4.40	0.56	0.23
	C	1.95	0.07	...	2.80	0.46	0.16
		1.76	0.11	...	2.93	0.40	0.06

TABLE 3.—Draeger Apparatus—Model 1904/09. Air Entering per Minute.

Depression of the Injector 120 Millimetres. Setting of the Blow-off Valve 40 Millimetres.

Point on apparatus where test was taken (Fig. 1).	Person Exercising	Resting. Size of Leak. 5 mm.	2 mm.	1 mm.	After Run. Size of Leak. 5 mm.	2 mm.	1 mm.
1	A	0.12	...	...	0.46	...	...
		0.22	...	...	0.60	...	...
	B	0.40	...	...	0.80	...	...
		0.55	...	...	1.63	...	...
		0.57	...	...	0.93	...	...
		0.32	...	...	1.46	...	...
2	A	1.05	...	...	2.72	0.26	...
		0.72	...	...	2.66	0.26	0.13
	B	0.52	...	...	2.46	0.06	...
		1.17	...	...	3.52	...	...
	C	0.50	...	...	2.93	0.33	0.13
		1.05	...	...	3.52	0.40	...
3	A	0.30	...	...	0.66	...	...
		0.45	...	...	0.86	0.20	...
	B	0.62	...	...	1.13	0.13	...
		1.02	...	...	2.33	...	...
	C	0.50	...	...	1.00	...	...
		0.70	...	...	1.00	...	...
4	A	1.10	0.28	...	2.00	0.80	...
		1.60	...	...	2.40	0.46	0.13
	B	1.46	...	...	2.93	0.33	...
		1.95	...	...	3.52	0.46	0.06
	C	1.46	...	...	2.93	0.40	0.13
		1.76	...	...	2.93	0.46	0.16
5	A	0.95	0.38	...	2.00	0.60	0.13
		1.47	0.12	...	2.80	0.73	0.20
	B	1.76	0.05	...	3.52	0.53	...
		1.95	0.07	...	3.52	0.46	0.13
	C	1.46	0.07	...	2.93	0.86	0.10
		1.35	0.20	...	3.52	0.73	0.16

TABLE 4.—Draeger Apparatus, Model 1911. Air Entering per Minute.

Depression of the Injector 100 Millimetres. Setting of the Blow-off Valve 40 Millimetres.

Point on apparatus where test was taken (Fig. 3).	Person Exercising	Resting. Size of Leak. 5 mm.	2 mm.	1 mm.	After Run. Size of Leak. 5 mm.	2 mm.	1 mm.
1	A	...	...	...	...	...	...
		...	...	...	...	...	...
	B	...	...	...	0.53	...	...
		0.07	...	...	0.26	...	...
	C	...	...	...	...	...	...
		...	...	...	0.20	...	...
2	A	...	...	...	1.00	0.20	...
		...	...	...	0.80	0.06	0.13
	B	0.87	...	...	2.40	0.60	0.20
		1.25	...	...	1.86	0.20	0.46
	C	0.50	...	...	2.26	0.33	0.13
		0.45	...	...	2.26	0.20	0.13
3	A	0.32	0.12	...	0.20	0.26	...
		0.20	0.15	...	0.50	0.20	...
	B	0.50	0.05	...	1.66	0.26	...
		0.67	...	...	0.80	0.26	...
	C	0.15	0.10	...	0.80	0.20	...
		0.55	...	...	0.73	0.20	...

TABLE 5.—Westfalia Apparatus, Model 1912. Air Entering per Minute.

Depression of the Injector 110 Millimetres. Setting of Blow-off Valve 18 Millimetres.

Point on apparatus where test (Fig. 4).	Person Exercising	Resting. Size of Leak. 5 mm.	2 mm.	1 mm.	After Run. Size of Leak. 5 mm.	2 mm.	1 mm.
1	A	0.08	...	...	0.27	...	...
		0.07	...	...	0.13	...	...
	C	0.20	...	...	0.33	...	...
		0.32	...	...	0.33	...	...
2	A	0.80	...	...	1.80	0.07	...
		1.25	...	...	2.80	0.07	...
	C	1.33	0.10	...	2.53	0.33	...
		1.33	...	...	2.40	0.33	...
3	A	0.90	0.08	...	1.70	0.20	0.07
		1.30	...	...	2.33	0.20	...
	C	2.20	0.42	...	2.93	0.60	...
		2.20	0.20	...	2.73	0.73	0.13

Note.—Person "B" was taken sick and is not included.

TABLE 6.—Fleuss Apparatus. Air Entering per Minute.

Point on apparatus where test was taken (Fig. 5).	Person Exercising	Resting. Size of Leak. 5 mm.	2 mm.	1 mm.	After Run. Size of Leak. 5 mm.	2 mm.	1 mm.
1	A	0.62	...	...	1.30	...	...
		0.92	...	...	0.90	...	...
	B	0.92	...	...	2.13	...	...
		1.10	...	...	2.53	...	...
	C	0.85	...	...	2.80	...	...
		0.75	...	...	2.40	...	...
2	A	1.40	...	...	6.50	0.57	...
		1.60	...	...	5.00	0.33	...
	B	1.76	...	...	4.40	0.73	...
		1.76	...	...	4.40	0.73	...
	C	1.76	...	...	4.40	1.33	...
		1.46	...	...	5.86	0.80	...

Tables 2 to 5 show the results of the measurements on the Westfalia and Draeger apparatus. It is at once seen that the latest models of both these firms show better results in regard to admission of outer air than the old models, although the old types give no occasion for criticism.

Under strenuous effort and with an opening of one millimetre diameter considerably less than ½ litre of outer air gains entrance into the apparatus. With an opening of 2 mm. diameter, if no work is performed, the volume of incoming air is even less. Under conditions of strenuous work and in some parts of the apparatus the volume of indrawn air can be greater than ½ litre; with an opening of 5 mm. diameter, without work, it is considerably greater than the critical volume of ½ litre. In order to properly value the meaning of these experiments it must be remembered that no person can perform for any length of time such strenuous work as was possible in the short duration of the tests. After a period of hard work rest must follow. It may, therefore, be assumed that in an extended period of use the incoming air would be about the mean of that registered under conditions of work and under conditions of rest. But this mean with an opening of 2 mm. is less than half a litre per minute. It can only exceed this figure at point 5, just in front of the injector. This point is so protected, however, that the presence of a leak is unthinkable. Therefore a leak, corresponding to a hole of 2 mm. diameter, would not be dangerous in the presence of carbon-monoxide, as unconsciousness only supervenes when for two hours more than half a litre of outer air is taken into the apparatus having a monoxide content of one per cent. Further, a higher percentage of carbon-dioxide in fire-gases cannot be dangerous, as the regenerators of the Westfalia and the Draeger apparatus are so adequately designed that they could absorb the carbon-dioxide which such a leak would admit without shortening their normal duration. At the highest they would only be required to deal with 6 to 7 litres, as up to the present the highest recorded percentage of carbon-dioxide in fire-gases has been 12 per cent.

Of course a greater leak than 2 mm. diameter would endanger the life of the wearer of an apparatus in the presence of an atmosphere holding a high percentage of monoxide. Such a leak can be detected with ease, and a leak of 2 mm. cannot remain undetected if proper tests are applied before an apparatus is taken out for use, for with a leak of 2 mm. the negative pressure will drop from 15 to 20 mm., and with greater leaks correspondingly more quickly. For example, a 5 mm. leak will cause a drop of almost half, that is, from 50 to 60 mm. Such a difference must speedily be detected if the depression meter is used for testing. The leak would also be quickly noticed if the apparatus be tested by blowing

through it, as prescribed by rule in the Ruhr district.

On the ground of these tests the conclusion we must arrive at is that Professor Cadman has greatly exaggerated the possible danger, and that the usual prescribed tests are sufficient to avoid any dangers that may arise through leaks in an apparatus. Of course, where apparatus is not carefully kept in good order, and if the proper tests are not applied before use, the life of the wearer may be placed in danger. In such a case, however, there are many other possibilities of danger, at least as important. Professor Cadman's conclusions that injector apparatus should be displaced altogether in favour of non-injector apparatus is not sustained. Moreover, Professor Cadman has overlooked the fact that in apparatus without injectors the outer air may gain entrance. In the only apparatus without injector to which I have had access, the Fleuss, according to my experiments (see Table 6) a leak of 2 mm. and of 5 mm. diameter at point 2 (See Fig. 5) under work conditions will admit more outer air than under similar circumstances and at the same testing points in the injector apparatus.

THE CONSOLIDATED MINING AND SMELTING CO. OF CANADA

The report of the Consolidated Mining and Smelting Co., of Canada, Ltd., for the period of fifteen months ending Sept. 13, 1913, has been issued.

The report of the President, Mr. W. D. Matthews, says:

The net profit, after deducting $146,019.30 for development, and $193,256.06 for depreciation, amounts to $998,367.14, out of which three dividends (a total of 8 per cent.), amounting to $464,352 have been paid, leaving a balance of $534,015.14, which, added to the balance at the credit of the Profit and Loss Account as shown last year, makes a total of $1,717,650.49 at the credit of that account.

During the year the Property Account has been increased by the sum of $232,113.73, the following properties having been acquired: The Monte Christo, Iron Horse, Abe Lincoln, and Virginia claims, adjoining the company's Rossland properties, the No. 1 group and the Highland group at Ainsworth, and the Ottawa mine at Springer creek, Slocan district. An interest in the Silver King group of mines at Nelson has also been acquired, and an agreement has been entered into to operate the property.

The plants at the various properties have been well maintained, and alterations and improvements have been made at the smelter to take care of the increased tonnage of ore, and also to reduce cost of operating.

Mr. R. H. Stewart, general manager, says, in part:

Operations for the fifteen months show a net profit of $998,367.14, after writing off $193,256.06 for depreciation on plant and equipment, and $146,019.30 for development, and charging to Profit and Loss Account $598,239.96 expended during the period in the development of our properties. Increase in plant account for the fifteen months, deducting depreciation, sales of plant and sundry fire losses, amounted to $103,071.82. Increase in property account, less development written off, $232,113.73. Expenditures on property account included completion of the purchase of the Fort Steel Mining and Smelting Company's stock and bonds; the purchase of sundry mineral claims adjoining the company's properties in Rossland; the purchase of an outstanding interest in the Achilles and Florence fractions, part of the Molly Gibson group; completion of the purchase and development of the No. 1 and Highland groups at Ainsworth; the purchase of the Ottawa group of mineral claims near Slocan City, and expenditure on development of various claims, which the company has had under option.

The amount due to banks for borrowed capital is $197,970.44.

Average quotations for metals for the fifteen months are as follows: London Lead £18 19s. 7d. as compared with £15,593 during the previous year; New York silver 60.993 cents as compared with 56.355 cents; electrolytic copper 16.113 cents as compared with 13.942 cents.

The total tonnage smelted at Trail was 407,124 tons, having a gross value of $8,335,668.00; showing an increase in the average monthly tonnage smelted over last year of about 2,400 tons.

The company's mines in Rossland show an encouraging increase in the amount of ore developed, a considerable part of this increase being due to tonnage developed in the Le Roi.

Development in depth from the War Eagle mine continues to prove encouraging, a large body of ore, of good grade, having been opened up on the 14th level. A cross-cut from the Centre Star shaft is now being driven, to reach this vein at a depth of three hundred feet below this 14th level, and should reach the vein early next year.

Development in the Le Roi mine has been satisfactory in finding new ore.

A dispute regarding the rights to mine certain veins apexing near the north boundary of the Le Roi, where it adjoins the property of the Le Roi No. 2, was settled by an agreement between the two companies, involving an exchange of certain parts of the properties of both companies and the substitution of definite planes for extralateral rights. This agreement should do away with any cause for disputes of this nature with the Le Roi No. 2 Company in future.

At Kimberley, development of the Sullivan group has been satisfactory in opening up new ore, and the mine should continue to produce for a good many years to come.

At Moyie a small tonage has been shipped from the St. Eugene mine, but no large bodies of new ore have been discovered.

The Molly Gibson mine was closed down for about six months last winter, owing to snowslides, which carried away a considerable part of the tramway. The tramway has been repaired and development is proceeding satisfactorily. The cross-cut tunnel mentioned in last year's report, has opened up considerable new ore, much of it of very good grade, and the mine looks better than ever before. Owing to its situation development is necessarily slow, but the mine should, in time, be a producer of considerable profit.

At Sandon there have been no new developments in the Richmond Eureka group, which still continues to produce a small tonnage.

At Ainsworth the No. 1 mine has been producing ore comparatively steadily, and developing with favourable results. The Highland group is also being developed with fairly satisfactory results. This mine has also commenced producing, and results are favourable. The Maestro, Libby, Banker, and Tiger properties adjoining, or close to the Highland and No. 1 groups, and which the company has under option, have developed to a small extent and some ore has been produced under lease.

At Salmo the Silver Dollar mine, which the company has had under option, has not been developed to any extent, owing to labour difficulties.

At Boundary Falls the No. 7 mine was operated for a part of the year to supply silicious ore, which was at that time lacking at the smelter.

In the Phoenix camp no work was done.

New Properties.—At Slocan City the Ottawa mine was purchased at a low figure, and a small amount of development has opened up a shoot of high grade ore, which will probably prove profitable.

At Silverton the company has under bond the Lucky Thought mine, on which some development has been done, but so far without very definite results.

A small amount of money was spent in developing a group of claims on the Coast, but the option was dropped as the property did not appear to be sufficiently promising.

At Nelson the property of the Silver King Mines, Limited, has been operated. This property includes the Silver King and surrounding claims, and formerly produced a large amount of silver-copper ore, but has been closed down for some years. Development has been carried on and some shipments made, but so far with no very definite results.

Improvements.—The total charge to construction account includes amounts taken into account on account of plant or properties purchased during the period, amounting in all to $64,400.00.

Besides this the principal expenditures have been about as follows:

In Rossland in connection with experimental work on concentration, which has been carried on at the Le Roi experimental mill; and the installation of an electric motor at one of the Le Roi compressors (made necessary on account of shortage of compressed air, due to increase of production and development in the company's mines in Rossland).

The head-works at the War Eagle mine were destroyed by fire during the year, and insurance to the amount of $22,000.00 was received therefor. The loss of these head-works did not, however, interfere with operations to any extent, owing to the fact that the War Eagle shaft was being used mainly for the movement of men and supplies, the ore being hoisted through the Centre Star shaft.

The assay office at the Centre Star mine was also partially destroyed and was replaced by a new one more conveniently located.

At Ainsworth were installed an aerial tramway from the No. 1 mine to the lake (length about 9,000 feet); also a small compressor plant.

At the Highland mine a small water-operated air compressor at the Highland mill and an air-line from the mill to the mine have been installed.

At Kimberley, the principal improvements were further accommodations for the men, and general equipment required for increased production and for further development.

At Trail the principal improvements have been alterations in the machine and blacksmith shops, and the transfer of machinery for these shops from the old Le Roi plant; the re-building of one of the copper furnaces and increasing its length to thirty-five feet; preparation for installation of a new lead furnace, and for re-building the lead furnaces; preparations for the installation of a new blower and of cranes for handling material in the blast furnace building; re-building of the Heberlein plant to reduce costs of operation and to take care of increased tonnage of lead ores; including the installation of a crane for handling the Heberlein pots, and of a 24 x 36 jaw crusher and grab bucket for handling sinter, and the purchase of additional Heberlein pots; the purchase of additional electric locomotives; of two Wedge roasters to take care of increased tonnage of lead ores; the installation of a gas-producer for the Dwight and Lloyd roasters, to replace firing with gasoline.

General Conditions.—There has been considerable improvement in mining throughout the Kootenay district. Customs ores received amounted to 97,823 tons for the fifteen months, as compared with 47,257 tons in the previous year. Considerable new ore is reported as having been discovered and a number of new properties have been on the list of shippers, some of them properties that have been idle for a number of years.

Management.—The properties and departments of the company have been in charge of the following gentlemen:

Mr. S. G. Blaylock, assistant general manager; T. W. Bingay, comptroller; James Buchanan, superintendent of smelter; M. H. Sullivan, assistant superintendent of smelter; J. F. Miller, superintendent of refinery; M. E. Purcell, superintendent Centre Star group of mines; E. G. Montgomery, assistant superintendent; F. S. Peters, superintendent Le Roi mine; C. H. McDougall, St. Eugene and Sullivan mines; K. B. Carruthers, Molly Gibson mine; W. A. Cameron, Slocan Lake properties; W. M. Archibald, J. M. Turnbull, and A. W. Davis, mining engineers.

FELDSPAR.

This mineral is employed at the present time almost entirely in the pottery industry (where, in a finely ground form, it is mixed with the clay to act as a flux), or in the enamelling of cooking and similar utensils. Attempts are being made also to utilize the mineral as a source of potash, of which it contains as high as 14 per cent.

Feldspar has been mined in Canada since the year 1890, and the present average annual production is 12,000 tons. Practically the whole of the output is exported to the United States, where it is consumed in the New Jersey and Ohio potteries. Almost the entire production of Canadian feldspar is derived from the Province of Ontario—the principal mines being located in the county of Frontenac, about twenty miles north of the town of Kingston on the St. Lawrence River. A few small deposits also have been worked in the Parry Sound district, in the vicinity of the Muskoka Lakes. Formerly feldspar was mined to some extent also in the Province of Quebec—the deposits being located in Ottawa County. No development of these properties has taken place during recent years—the distance from the United States factories rendering mining unprofitable. One mine in this region yields a remarkably pure white feldspar, which is in demand for the manufacture of artificial teeth.

SMELTING THE COBALT SILVER ORES

By A. A. Cole.

(Continued from December 1 issue.)

Canadian Copper Company's Cobalt Plant.

The Cobalt plant of the Canadian Copper Company is situated at Copper Cliff, about ¼ mile south of the large copper-nickel smelting plant of the same company.

The works were designed to smelt and treat ores and concentrates from the Cobalt silver district, and have been in operation since December, 1905. This Cobalt plant is to be closed down permanently as soon as the values now on hand are recovered.

Treatment.—The ore is first crushed, ground in a ball mill to 30 mesh, and one-tenth cut out by a Synder sampler. Sampling is completed by coning and quartering. The first quartering divides the sample into two parts, which are worked down as two independent samples. The ore is charged with suitable fluxes in a 30 in. x 72 in. blast furnace, having a capacity of 25 to 30 tons per 24 hours. Limestone from Michigan is used as a basic flux, and low grade Cobalt ore when an acid flux is required.

Products of the blast furnaces are:

1. Silver.
2. Speiss.
3. Fumes containing flue dust, crude arsenic.
4. Slag.

1. The silver button represents an extraction of about 75 per cent. of the silver in the ore charged, and assays about 850 fine. The silver is charged into an oil-fired refining furnace, with a capacity of 30,000 ounces refined silver, which brings the grade up to 980 fine. It is shipped in bars to the Balbach Smelting and Refining Company, of Newark, N.J., for refining, and sold in New York.

The slag from the refining furnace is a revert to the blast furnace.

2. Speiss: The following is an analysis made of a sample of speiss taken over a month's run:

Silver 900 ounces per ton. Arsenic 24 per cent. Cobalt 27 per cent., Nickel 9 per cent., Copper 2 per cent., Sulphur 6 per cent., Iron 20 per cent.

The speiss is ground to 30 mesh, mixed with 20 per cent. salt and roasted in eight mechanically worked Edwards reverberatory roasters, fitted with water-cooled rabbles. Each roaster has a capacity of 2,400 lbs. per 24 hours.

The product or chloridized speiss is taken to the wet house where it is treated in cylinders with water, which dissolves the soluble salts of cobalt, nickel and copper. Solution is decanted and the copper precipitated on iron. The cobalt and nickel are then precipitated as hydroxides by a solution of soda carbonate, converted to oxides in an oil-fired furnace, ground in a pebble mill, and barrelled for shipment. An approximate assay of this material is as follows:

Silver 15 ounces per ton. Arsenic .3 per cent., Cobalt 40 per cent., Nickel 3 per cent.

Nickel runs lower than the usual proportion of nickel to cobalt for the reason that it is less easily converted to a soluble salt by the above treatment than cobalt.

The treatment of the speiss is continued with four covers of hyposulphite of soda solution which eliminates all the silver except 20 to 30 ounces per ton. The silver is precipitated from solution as a sulphide by treatment with a saturated sodium nitrate and 10 per cent. sodium carbonate, heated to redness in an oil-fired roasting furnace, transferred to leaching tanks where it is leached with hot water. This leaves a spongy mass of metallic silver with a small quantity of cobalt and nickel that has not been changed to the soluble state. The spongy mass which contains from 60 per cent. to 65 per cent. silver is added to the bath in the silver refining furnace.

The residues from the first hyposulphite leaching are mixed with quartz and smelted in a blast furnace for the elimination of the iron. The resultant products are:

(a) Slag.
(b) Speiss.
(c) Flue dust and crude arsenic.

(a) The slag, which contains 15 ounces silver per ton, 10 per cent. cobalt, and less than 1 per cent. nickel, is smelted with other high silver slags with pyrite from Capelton, Que.

(b) The speiss from this second smelting has the following approximate composition:

Silver 300 ounces per ton, Arsenic 25 per cent. to 30 per cent., Cobalt 35 per cent., Nickel 25 per cent., with a little sulphur when arsenic is low, Iron 3.5 per cent., Copper 2 per cent.

This speiss is treated as the first speiss up to the time when the first residue leaves the cylinder in the wet house. It then contains about 20 per cent. arsenic, and after mixing with 20 per cent. sodium nitrate and 10 per cent. sodium carbonate, it is given an oxidizing roast in a hand-rabbled reverberatory furnace. This transforms the arsenic to sodium arsenate which is leached out with hot water and discarded. The residue after drying has the following approximate composition:

Silver 20 to 30 ounces per ton, Arsenic .3 per cent. to .7 per cent., Cobalt 35 per cent. to 37 per cent., Nickel 23 per cent. to 25 per cent., Copper 3 per cent., Iron 5 per cent.

Payment is received for the silver in the above product, as well as for the cobalt and nickel oxides.

3. The arsenic from the blast furnace and roasting furnaces is collected in flues and recharged into an arsenic refining furnace. The residue is a clinker high in silver which is returned to the blast furnace. The final product is a refined white arsenic which contains 99.98 per cent. Arsenious Oxide (As_2O_3) with about .3 ounces of silver per ton.

4. The slag from the blast furnace is rejected except when it is found to run over 10 ounces silver per ton, in which case it forms a revert to the smelter.

Power is supplied from the company's plant at High Falls, 14 miles from the smelter. The Cobalt plant requires from 200 to 300 horse power. Eighty men are employed in this plant, working 12-hour shifts.

The following statement shows the ore treated and the production of the Cobalt plant of the Canadian Copper Company since the commencement of operations.

Operations of Canadian Copper Co.'s Cobalt Plant.

Year.	Ore treated. Lbs.	Silver. Fine ozs.	Cobalt.* Lbs.	Nickel.* Lbs.	White Arsenic. Lbs.
1906	1,767,692.5	1,282,692.78	9,021	3,987	.....
1907	4,560,627.5	3,829,542.82	331,151	138,427	510,622
1908	9,857,072.5	8,551,582.07	464,171	268,140	942,827
1909	10,651,189.5	8,779,014.55	690,737	463,588	1,242,722
1910	9,792,511.0	8,696,624,87	346,483	260,756	843,619
1911	6,744,108.0	6,584,102.46	238,684	234,323	680,074
1912	3,667,301.0	3,523,207.80	223,163	209,330	476,156
	47,040,502.0	41,246,767.35	2,303,410	1,578,551	4,696,020

*These figures represent the metallic nickel and cobalt contained in crude oxides in which form they are shipped.

Canada Refining and Smelting Co., Ltd.

The plant of the Canada Refining and Smelting Company is located on property owned by the company, consisting of about 11 acres, situated in the southern part of the town of Orillia, Ont., and adjacent to the Grand Trunk, Canadian Pacific, and Canadian Northern Railways.

Construction was started on the 1st September, 1910, and smelting commenced on the 20th February, 1911.

The plant is designed for the treatment of silver ores from Cobalt, and has a capacity of about 13 tons daily. It produces refined silver, white arsenic, and the mixed oxides of cobalt and nickel.

Treatment.—The crushing and sampling of the ore is done at Cobalt by Campbell and Deyell, samplers and assayers, before shipment to the smelter. The ore is first smelted in an Allis-Chalmers 48 in. circular shaft furnace, which produces:

1. Silver.
2. Speiss (argentiferous).
3. Fumes containing arsenic, silver, etc.
4. Slag.

I. The silver button which represents a silver extraction of about 80 per cent. and assays about 900 fine, is refined in a cupel furnace up to 996 fine and shipped. There are two of these refining furnaces each with a capacity of 70,000 ounces to a charge. The slag from the refining furnace reverts to the blast furnace. Limestone and iron ore are used as fluxes when required, the limestone coming from Longford Quarry, 9 miles distant from the smelter, and the iron ore from Midland, Ont.

2. The speiss is ground, roasted, reground, and sent to the Cobalt house. Here it is treated chemically and most of the metals, except the silver ore, are dissolved. The impure silver-bearing mud is separated from the liquor in filter presses and recharged in the cupola furnace.

The iron, arsenic and copper are first precipitated from the liquor and finally the cobalt and nickel are precipitated together as carbonates. The mixed carbonates are heated in a hearth furnace and converted to oxides, which after grinding are barrelled and shipped. The oxides assay about 40 per cent. cobalt and 25 per cent. nickel.

3. The arsenic fumes from the shaft and coasting furnaces are caught in the impure arsenic bag house, from which the arsenic is taken and treated in resubliming furnaces, where silver is retained in the residue and the arsenic drawn off and caught in the clean bag house, from which it is taken, ground and barrelled for commerce.

4. The slag from the blast furnace is discarded except when the silver contained makes it worth retreating, in which case it is recharged in the blast furnace.

About 300 horse power is required by the plant. This is supplied by the town of Orillia at the rate of $18.40 for a 24-hour service per horse power per year, from a hydro-electric installation 18 miles distant from the town.

The number of men employed at the works will average about 80.

Since the commencement of operations, to December 31st, 1912, ore treated and production has been as follows:

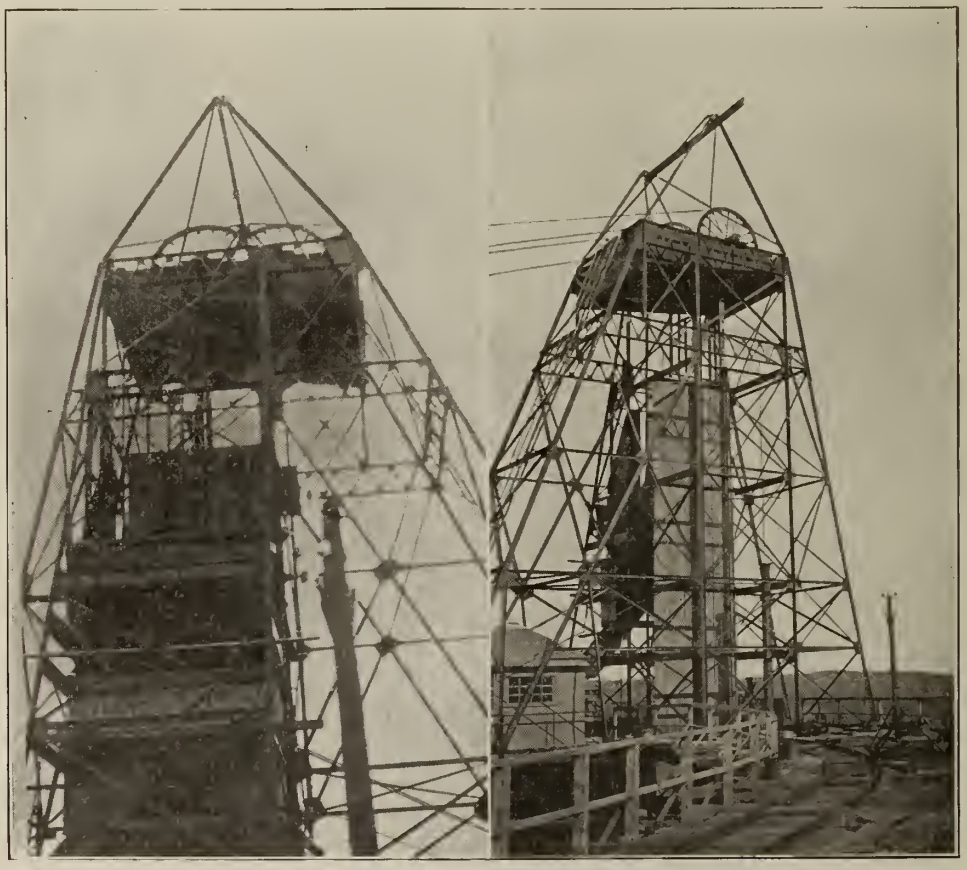
Operations of Canada Refining and Smelting Co.

	Ore Treated, Lbs.	Silver, Fine, Ozs.	Cobalt and Nickel Oxides Lbs.	Value.	Arsenic Lbs.	Value.
1911	1,635,488	1,719,743	10,825	$1,796.67	None	None
1912	3,324,545	3,303,641	79,640	13,477.78	250,088	$6,639.69

STORAGE AND MEASURING POCKETS AT NEGAUNEE MINE*

By S. R. Elliott.

In order to be able to handle rapidly two grades of ore and rock at No. 3 shaft, Negaunee mine, three compartment storage pockets were put in. The general plan and dimensions of these are shown in the accompanying drawings. From the centre compartment it is possible to load into either skip. If the grade of the larger tonnage is handled through this compartment, and a little care is used to keep a reserve in the pocket, it will never be necessary to run either skip up empty in order to continue to hoist from either of the other compartments. This may occur with a two compartment pocket if the grades of ore hoisted are of different proportions. With the exception of the front, which is made of wood, the entire pocket is concrete.



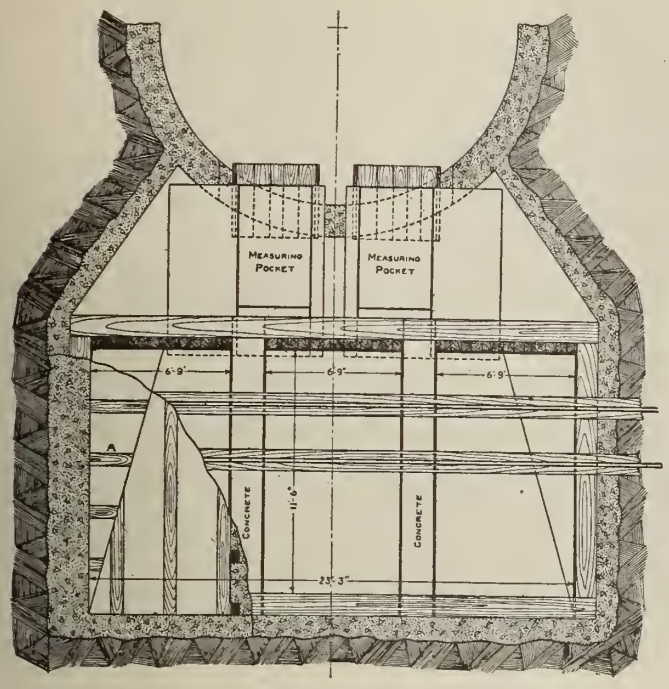
Head Works, Negaunee Mine

The sides are lined with plates, those in the lower part being one-half inch thick, while those in the upper are only one-quarter inch. The long dimensions of these plates extend horizontally instead of vertically, the object being to gradually decrease the thickness from the bottom, where there is the most wear, to the top where they would last for a great length of time. At intervals of 2 ft. 6 in. on the sides there are 5x7 timbers, to which the plates are bolted. These plates serve as forms behind which the concrete is dumped. As a rule, plates in pockets wear rapidly, due to the fact that they are not on a perfectly solid foundation. They buckle and in a short time ore gets behind them and they are shoved out of position. Plates in a concrete pocket are expected to last until they are completely worn out.

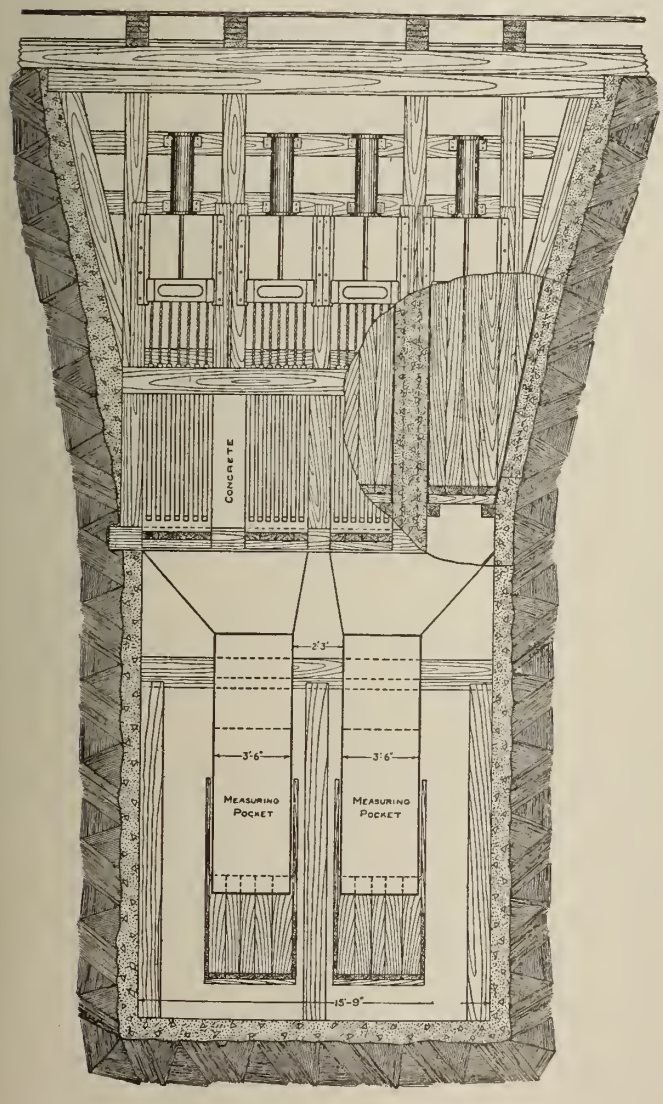
Some means had to be provided for the replacing of the plates when worn out. As the concrete completely fills the space back of the plates, it would be impossible to reach the nuts of the bolts, so the countersunk heads of the bolts were made like the head of a screw. Before dumping in the concrete the threads were well covered with grease to keep it from sticking, and after it had set for a sufficient length of time, so that there was no chance of the nuts turning, every bolt was loosened with a large screw driver and tightened again. When the plates were out the bolts can be removed and other plates put in position, the same nuts being used as many times as necessary, as they are firmly imbedded in the concrete.

The bottoms of the pockets are made out of two thicknesses of 3 in. hardwood plank, spiked to 5 x 7 in. timbers, placed at intervals of 2 ft. 6 in. Behind these

*Extract from paper entitled "Method of Raising, Sinking and Concreting, No. 3 Shaft, Negaunee Mine," presented at Houghton meeting of L. S. M. I., August, 1912. Photos by R. E. Hore.



Storage and Measuring Pockets, Negaunee Mine. (Plan)

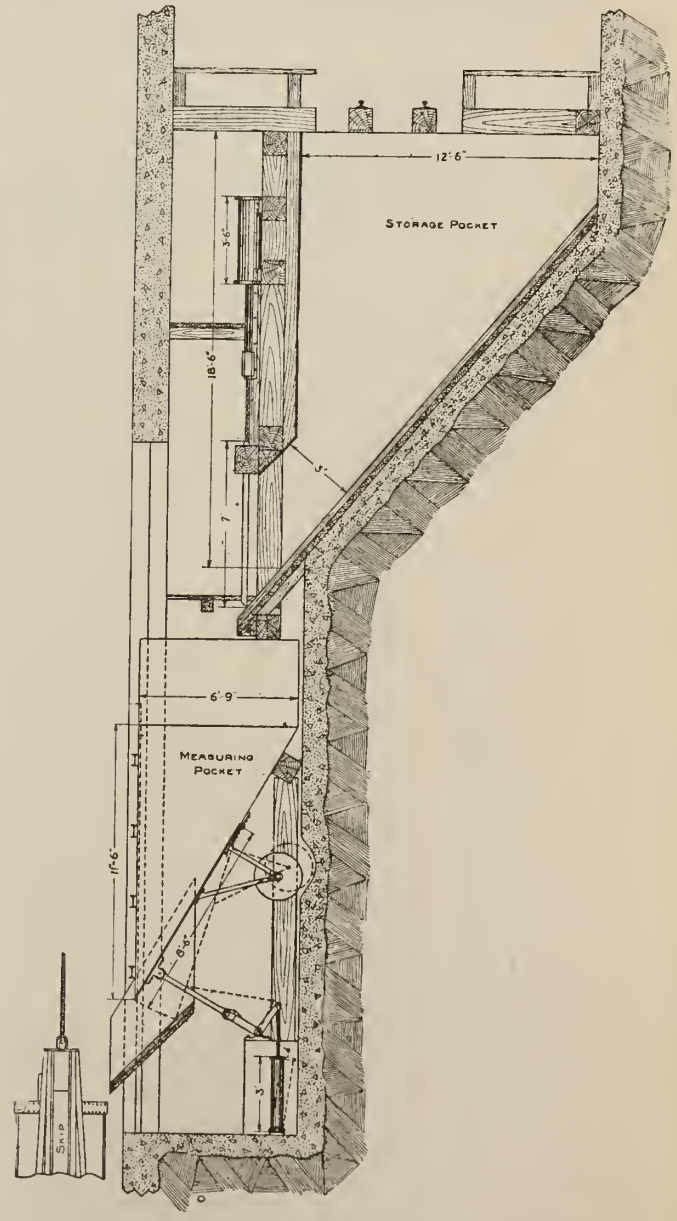


Storage and Measuring Pockets, Negaunee Mine. (Front Elevation)

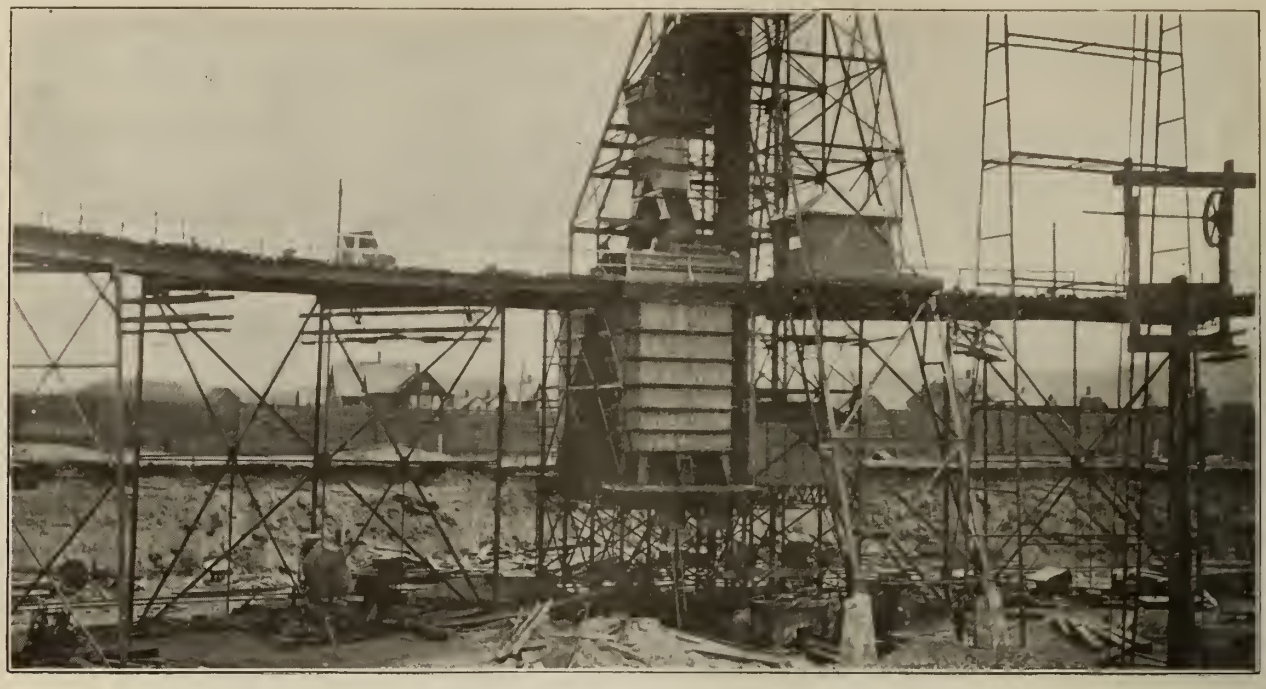
planks concrete was also dumped. When the upper planks wear out they will be removed and replaced by others.

Measuring Pockets.

Below the storage pockets there are two measuring pockets, which hold a skip load. While the skips are in motion the operator has time to draw the ore from the storage pockets and fill a measuring pocket. As soon as the empty skip is in position, it can be immediately filled by simply tripping a lever. One great disadvantage in the common style of measuring pocket is that the door opens towards the skips. If, for any reason, the operator fails to close the door before giving the signal to hoist, it will be torn out by the skip, causing great delay and damage. In order to avoid this possibility, and to make the operation as near "fool-proof" as possible, the pockets were designed with the doors opening away from the shaft. The ore falls on a slide from which it runs into the skips. The doors are made of two thicknesses of one-half inch plate, strongly braced by angle iron. They are counterweighted, closed and opened by small air cylinders. These have been found to work most satisfactorily and very rapid loading is possible.



Storage and Measuring Pockets, Negaunee Mine. (Side Elevation)



Head Works, Negaunee Mine.

BOOK REVIEWS

COMPRESSED AIR PRACTICE—By Frank Richards—McGraw Hill Book Company—Price $3.00 net—For sale by Book Department, Canadian Mining Journal.

This is a very interesting volume dealing with the use of compressed air in engineering work. The introductory chapters are devoted to general considerations of the properties of the air, and to definitions and general information. Tables and diagrams for computations in air compression are given and explained. The indicator and its uses are described. Separate chapters are devoted to single stage, 2-stage, and 3-stage compression. The turbo compressor and the Taylor compressor are described. The power cost of compressed air is dealt with in one chapter. The air receiver and some common faults of the usual type of receiver are described. The advantages of re-heating compressed air are pointed out. The rock drill is described in a very interesting way, and the great efficiency of these machines is well pointed out. One chapter is devoted to the description of the electric air drill, which the author believes to be in many ways superior to other types. The use of compressed air for raising water is described. The principle of the diving bell and caisson and their uses are described.

The book closes with a chapter on Liquid Air.

Our readers will find this book a very interesting and useful one. A great amount of information is well given in simple and brief form.

ECONOMIC GEOLOGY—By Charles H. Richardson—McGraw Hill Book Company—Price $2.50 net—For sale by Book Department, Canadian Mining Journal.

This work is not a treatise on the subject, but a compilation of notes used in connection with a series of lectures. For the students for whom it is written, it will doubtless be very useful. It is doubtful, however, whether the work will find other fields of usefulness.

The description of many important ore deposits is very brief and unsatisfactory. Numerous statements concerning the origin of ore deposits are made without giving detailed description of the nature of the deposits, and without presenting any argument. The opinions of many writers are merely stated. The reasoning is not given and the reader is not encouraged to think for himself.

There are some interesting diagrams in the book which have been taken from reports by earlier writers, and a few original photographs and drawings.

The volume is made up of ten chapters. Ore Deposits; Origin of Ore Deposits; Precious Metals; Useful Metals (Group 1); Useful Metals (Group 2, Sub-Group A); Useful Metals (Group 2, Sub-Group B); Useful Metals (Group 3); Useful Metals (Group 4); Rare Metals, and Economics.

THE COLLIERY MANAGER'S POCKET BOOK, 1914—Edited by Hubert Greenwell, Joint Editor of the Colliery Guardian—The Colliery Guardian Co., Ltd.

This little book contains a great deal of information for those interested in coal mining. A review of mining progress during 1913 is presented. Mining statistics, mining institutes, miners' relief fund, examinations, strength of materials, machinery, ventilation, surveying, uses of rescue and ambulance, general regulations, electricity, valuation, depreciation and explosives are among the subjects dealt with.

CANADIAN TRADE INDEX—Issue of 1913-1915—Compiled and published by the Canadian Manufacturers' Association—Price $3.

This volume is a directory of the manufacturers in Canada classified according to the articles made. The primary aim of the publishers has been to provide buyers of Canadian manufactured goods with a dependable list of the articles made in Canada, and the names of the manufacturers making them.

In addition to the very complete index which forms the major part of the volume, there is considerable useful general information. The book should prove to be very useful to buyers of all classes of manufactured articles.

THE MODERN ROCK DRILL*

By W. L. Saunders.

The mining drill at the present time is a machine which weighs from 60 to 150 lbs. It is largely a one-man machine, though under many conditions of work it is still best to add a helper. The percussive or piston type still holds its supremacy for heavy work, even in mines where large stopes are encountered, as, for instance, at the Homestake, but this percussive drill is now a machine which safely withstands pressures of from 100 to 110 lbs. and its weight has been considerably reduced because of changes made in both design and material. This type of drill now used in the stopes at the Homestake weighs 137 lbs. unmounted, and mounted on column with arm about 375 lbs. Its work is chiefly in down-holes. Each part of the machine represents a study in material. The metal itself and the treatment it receives in the shops are both regulated in accordance with the work that each particular part has to perform. All our knowledge of metallurgy is taken advantage of in the construction of the drill. The cast iron is not ordinary cast iron. It resembles it only in that the metal is cast. The composition is made up to suit rock-drill service and the metal is treated with special reference to the work it is to do. The steel is not common steel, but it is alloyed to suit each particular part. It receives a hot, crude oil bath and it goes through many processes before it is finally coupled up with the other parts into a complete drill. Special metal and special treatment are not confined to the piston or percussive type, but they apply equally to the hammer type. In fact, it was because of the necessity for lighter weight and greater strength in the hammer type that the study of the metallurgy of the rock drill was initiated and carried to a successful issue.

The first great improvement made in the piston or percussive type has been in the metal used, and this has resulted in greater strength, greater durability, and a lighter weight of machine for higher pressures. There has also been a change in design, which in the main has been confined to the valve motion. The chief aim of the designer has been to get greater speed. This means a greater number of blows, and in order to do this valves have been provided which open and close quickly and which have large ports. It is obvious that, other things being equal, a piston type of drill of large piston area will do more work than the same type of drill with a smaller area. The larger machine, which drills more, is handicapped by its weight, and when the net efficiency is figured up it has been found that it sometimes pays to get less drilling capacity with a machine which is more readily handled. Here the question of upkeep is introduced, because generally speaking the heavy type of machine costs less for repairs than the lighter type. The designer, taking all these things into consideration, has sought to increase the diameter of the piston so as to provide the drilling capacity of the heavy type with a machine of considerably less size and weight. This has in a measure been accomplished by the use of superior material and a design which shortens the piston, putting the extra bearing into the front head, where it is lighter. Through the use of a type of valve known as the butterfly a quick opening of large area is provided, thus increasing the number of strokes and thereby bringing up the drilling capacity. This has been done with no increase in air consumption that is not compensated for by increased drilling power.

Air consumption in rock drills is much misunderstood. Assuming that the piston and valves are tight, in other words, where there is no leakage, air consumption is usually dependent upon the number of strokes delivered. It is assumed, of course, that a constant diameter and length of stroke are used and that the pressure is uniform. It is plain that if we are able to utilize air or steam at 100 lbs. gauge pressure for the full length of stroke when a percussive drill delivers its blow we are going to get the best results in drilling capacity; that is, we are going to get the hardest blow that is commensurate with the diameter, length of stroke, and pressure of the machine. If this blow is too hard, that is, if it breaks the steel, destroys the bit, or creates a condition where the drill is unmanageable on its mounting, then we have the alternative of reducing the size of the machine and in this way getting lighter weight, which is always desirable when it is consistent with the other conditions. We all know that the class of rock usually determines whether or not we are striking too hard a blow, but assuming that the class of rock is uniform, or that it is determined and understood, the engineer is obviously justified in providing a drill which will strike the hardest blow that the machine and the rock will stand without destructive consequences. We see, therefore, how important it is to start with a machine which has a valve motion and ports so designed that the full power pressure will follow the piston the full stroke until the blow is delivered. Having this condition, as light a machine should be used as will stand up to the work.

It naturally occurs to one that a quick-opening valve and a large port will bring about greater speed, but the question is asked, is not this condition wasteful in air consumption on the return or back stroke? It will be generally admitted that it pays to get the blow, but why should the same conditions that give us the blow obtain when the piston returns for another stroke? There are two reasons why this is advantageous. One is, that the pull-back on a piston type of rock drill is sometimes of as great importance in the long run as the blow. A weak pull-back reduces the speed of the machine, causing it to come back more slowly than it went forward, and it has the further disadvantage that holes that are not straight, or which are out of round, and where seams and other irregularities are encountered, will act to retard the steel during its reciprocations. This considerably reduces the efficiency of the machine, not only because it cuts down the number of blows delivered, but because it weakens the strength of blow. The steel is held back in its effort to reach the full stroke and a laboured blow, with sometimes a shorter stroke, is the result. Now it is quite true that in good, clean, hard rock, without seams, and where holes are drilled to reasonable depths, it might pay to save air on the return stroke. As a matter of fact, this is always done in a piston drill because the diameter of the rod must be subtracted from the piston area. The percussive piston type of drill is naturally a compounded machine which hits a harder blow forward than backward, because it has the full piston area at one end and a reduced area at the other. It is not a difficult matter to regulate this to any degree desired by increasing or decreasing the size of the piston rod or by increasing or decreasing the valve and port areas on one end of the stroke and not on the other. But every attempt to compound a piston type of drill by putting a pressure in front of the piston is a mistake. Just in proportion as a pres-

*Extract from paper presented at Butte meeting, A.I.M.E., August, 1913.

sure is introduced in the front end it would cushion or restrict the force of blow, and in doing this, as has been previously pointed out, we make it necessary to increase the weight of the machine in order to get the effective maximum blow. It is, therefore, a very dangerous expedient in the design of piston drills to attempt to compound the stroke. Reduced air consumption is easily effected at the sacrifice of efficiency. Air at 100 lbs. is delivered to a percussive drill at a cost that varies from 40c. to $2 per day. To save 25 per cent. of this is all that compounding could reasonably be expected to accomplish, and this at the maximum is only 50c. a day. Experienced engineers will have no difficulty in seeing that there are many ways underground by which this and larger amounts may be lost through a machine which must inevitably be weakened in certain other directions in order to effect a small saving in air economy. Under most conditions of service it pays to conserve labour and upkeep expenses, giving first consideration to those things which cost most. A small reduction in drilling capacity or a few idle hours, means an expense which will easily run in excess of any possible saving in air.

The hammer type of drill is a natural air saver, and it is in the design and construction of this type that air economies may be effected safely and without sacrifice. The hammer drill is essentially a machine for mines. It represents the evolution of the rock drill from the piece of steel struck by a hammer through the various stages of percussive machines back again to the hammer-driven blow upon the steel, the difference being only that the blow is a rapid power blow. A hammer drill is economical in air consumption because, in the first place, it reciprocates a light plunger which weighs only a few pounds, while with the piston drill not only must the heavy piston be thrown backward and forward at high speed, but it carries with it the steel and bit. In hammer drills the power is utilized, not in overcoming the inertia of a heavy body, but in compensating for that inertia through the high speed of a light body. A heavy mass moving slowly may give the same impact of blow as a light mass moving rapidly. The effective work done at the bottom of the hole is represented by the weight multiplied by the velocity. The same effect may be produced by subtracting from the weight and adding to the velocity, or vice versa. In a piston or percussive drill, velocity is limited, while in a hammer drill it is practically unlimited, and here is where the great possibilities of hammer drills have come in.

We must always bear in mind in comparing piston and hammer drills that the piston drill is handicapped by the load of the piston and steel, which has a certain inertia difficult to overcome in our efforts to reach high speed. The stroke is necessarily short, and as the hole gets deeper this handicap of weight is increased by longer steels, so that we are driven to high air pressures in order to get high speed. High air pressures naturally cost more money than low air pressures, and, as has been shown, if we attempt to save air by compounding we limit the capacity of the drill to force itself through difficult places. In holes at or near the horizontal there is always an added disadvantage in a percussive type of drill, due to the steel dragging in the hole. This will take place even in a clean, straight, round hole. The steel sags, and in sagging, and during the process of rotation, there is considerable friction loss within the hole. All this leads us to high pressures, which is only another expression for greater power. It is safe to say that the piston type of drill has reached its limit when we consider capacity as a limitation when rating efficiency. In down-hole service, especially for deep holes and in soft rocks, piston drills will always be useful. The pumping action of the bit serves to agitate the material at the bottom, especially when mixed with water, and in this way the hole is kept more or less clean under the bit.

The study of rock-drill economics has led the mechanical engineer into the hammer-drill field as one which offered the greater possibilities. The problem was to do more work and with a lighter machine. The next consideration was to accomplish this with a reduced labour and power cost. All of these conditions have been met and, as subsequent figures will show, extraordinary results have been obtained which have materially reduced the cost of excavating rock and ore. We have seen that the process has been one of return to primitive methods. In other words, we have done what is most natural, and that which conforms closest to the laws of Nature is invariably best. The natural way to drill rock is to strike a piece of steel with a hammer. The only reason why the miner does not continue to do things in this way is because he cannot strike a sufficient number of blows. Just in proportion as he uses a heavier hammer does he reduce the number of blows that he is able to maintain and with the lighter hammer he is brought to an absolute limit. It would seem that the first thought of the engineer would have been to follow the old miner by building a rock drill on the hammer type. He may have thought of this, but the problem proved to be a very difficult one. The first difficulty was to get material that would stand up against this rapid-fire system. Then came the question of rotation, which was not easy to accomplish with a machine of the hammer design. Of equal importance was the question of keeping the bottom of the hole clean, because the bit being practically stationary at the bottom, the cuttings from the hole would pack between the edges of the bit and the bottom of the hole and prevent further progress. Jets of steam, of air, and of water were used to discharge the cuttings. Steam has many disadvantages, air is expensive and it creates dust, while water is, in the first place, difficult to introduce into the bottom of the hole, its mixture with parts of the drill results in wear and tear, and to use much water is a disadvantage and an expense in underground work. Up-hole work offers less difficulties for hammer-drill service than any other. The cuttings drop by gravity out of the hole and the only disadvantage is dust. Horizontal hole work is that which is most difficult, while with down-holes water thrown into the hole always serves a useful purpose. A mixture of air and water has solved most of the problems arising from the use of hammer drills in mines. This is known as the Leyner system. Air is always available and is readily conducted in the hole, using either live or exhaust air. Where this air is commingled with water it discharges the cuttings from the bottom of the hole without blowing them away in the form of dust, but by simply reducing them to a puddle condition with enough water only to create a moderate stream, which discharges the cuttings through the orifice of the hole. This keeps the bit cool, there is enough puff to the air to remove the chips, and a long experience under all conditions of service has demonstrated conclusively that a mixture of air and water is more effective in cleaning the hole than even a large stream of water alone. In fact, air is the ideal thing to use, and it would be used alone were it not for the dust, so that the present system introduces only enough water to lay the dust. In doing this we effect economies by using only a small amount of water mixed with air from the exhaust.

The pneumatic tool, especially the type known as the riveter, illustrates the mechanical principles involved in the hammer drill. It is likely that the perfection of the pneumatic tool led to the perfection of the hammer drill. A riveter combines an extraordinary amount of power.

Its efficiency is very high because the hammer speed is high, and the machine is light and easily handled. Its use in steel and iron construction is now universal. Air consumption in a tool of this nature is low in proportion to the work it does, because the thing reciprocated by the air is so light that it is easy to get high speed without sacrificing power to overcome inertia. In other words, there is a closer relation between the air pressure and the speed of hammer, with the resultant effective blow.

A point not to be lost sight of is that the rapid reciprocation of a flying piston, as in a hammer drill, is very much more easily mounted or held by an abutment than where we have a reciprocating action of a heavy weight, as in the case of a piston drill. The reasons for this are obvious. High speed of a light hammer takes the place of slow speed of a heavy hammer. One is like the rapid reciprocations of a hand hammer, the other the ponderous swing of a sledge. So great an effect is obtained by this rapid, light blow that it has been found practicable to reduce the weight to a figure considerably under 100 lbs. in a machine which in drilling capacity compares favourably with a piston drill of two or three times the weight. In this light machine, material alone has not enabled us to cut down the weight, but the light rapidly moving piston design, with the quick-opening valve, is of equal importance. It would surprise a drill runner of 10 years ago to learn that hammer drills are used to-day in hard rock, putting in holes 10 and 15 ft. in depth without even mounting the drill, it being held in the hand of the operator. Of equal importance in tunnel driving is the fact that by the use of hammer drills the equivalent of heavy machines is placed in the headings mounted upon a light horizontal bar, this bar being easily handled by a few men, yet it affords abutment enough to resist the jar, because the jar has been reduced to a minimum. Heavy upright columns, carriages, and other forms of support were made necessary because of the ponderous pulsations of the piston drill. To be able to use a light bar, placed horizontally, is of the greatest importance in tunnel driving because it affords an opportunity to begin drilling quickly after a blast and before the muck has been cleared away from the bottom of the heading. This has been referred to in detail in the paper of D. W. Brunton, Notes on the Laramie Tunnel.

An effort has been made in the foregoing statements to analyze and give reasons for a condition in rock-drill service which is now in practical operation.

A hammer drill is the modern progressive miner. It has practically done away with hand drilling and in doing this it has largely increased the field of service. There is no longer any question about the fact that it pays to use power drills in all classes of mining. It is now entirely a question of adapting the system of mining to these light, efficient, handy perforators. In August, 1912, there was held at Calumet, Mich., what is perhaps the last contest between hand and power drilling. A three-man double-jack team of the best drillers in the copper country was pitted for a money prize against a small hammer drill of the Butterfly type. This machine was operated by one man. The drilling was in a block of Cape Ann granite, 60 in. thick. The three-man drilling team started with a 1¼-in. bit and finished with a ⅞-in. bit. The one man with the Butterfly (this is a light hand hammer drill, of the usual plugger type, weighing about 40 lbs.) used a 2-in. starter and finished with a 1¼-in. bit. It required 14 min. for the machine to drill entirely through the block (60 in.), while the hammer-and-drill squad put in a 49-in. hole in the same time. The machine did 20 per cent. more work with one-third the labour cost. As a matter of fact, no such rate of hand drilling as was shown by the three-man squad could be maintained over a working shift, while there is no reason why the machine drill should not keep up its speed indefinitely.

ANNUAL REPORT OF THE GRANBY CONSOLIDATED CO.

The annual report of the Granby Consolidated Mining, Smelting and Power Co., Ltd., for its fiscal year ended June 30, 1913, was made public at the annual general meeting of shareholders, held in New York City, on October 7. It shows an operating profit of $1.214,599, or a little more than $8 a share on its 150,000 issued shares. This compares with net earnings of $583,379 for the fiscal year to June 30, 1912, during which year, however, mines and smeltery were idle four months, besides having during three months of smelting operations the higher cost of Pennsylvania coke when none was obtainable from Crowsnest collieries.

Figures showing production and average prices of metals, and gross receipts for same, follow, with figures in brackets for the immediately preceding fiscal year for purpose of comparison: Copper produced, 22,688,614 lbs. (13,231,121 lbs); silver, 324,336 ozs. (225,305 ozs.); gold, 47,266 ozs. (33,932 ozs.). Gross receipts for products, $4,782,691 ($2,874,760). Average prices of metals were: Copper, $0.1604 a lb. ($0.1558); silver, $0.6118 an oz. ($0.5906); gold, $20 an oz. ($20).

The year's net earnings available for dividends were reduced to the extent of $80,665 by fixed charges, which represent the interest on its $1,500,000 of bonds issued last May, and by $829 charged to depreciation, says the Boston Commercial. Its final net earnings per share, therefore, amounted to $7.55, and its surplus above dividends for the year was $683,149.

In the year to June 30, 1912, Granby Co. charged $979,461 to its Hidden Creek mines investment, that amount having been expended out of its treasury surplus. In 1913 no charge was made to its Hidden Creek investment, its expenditures on the equipment of its new property having been paid for with the proceeds of its bond sale. The actual investment at the Hidden Creek property the past year amounted to $1,958,724; altogether this property and its equipment represents an expenditure by the company of $2,038,185 to the end of the last fiscal year.

On June 30, 1913, the company had a surplus of cash and liquid assets over current liabilities of $2,587,924, which Mr. Geo. L. Walker calculates equals $17.25 a share of its stock.

President William H. Nichols says: "The ore reserves at the mines at Phoenix have not been fully maintained, being now reduced to 5,613,000 tons and the recoveries are reduced to 17.68 lbs. of copper per ton of ore. The cost per ton of ore was the lowest in the history of the company.

"At the Hidden Creek mines, Anyox, Observatory inlet, the ore reserves have been materially increased, the estimates now being 7,759,000 tons, carrying 2.2 per cent. of copper, which is regarded as ample advance provision for the 2,000-ton smelter now approaching completion. It is confidently expected that smelting will be commenced early in the new year."

Last year's directors were re-elected, and at the organization meeting the former officers were reappointed with the exception that Mr. F. M. Sylvester was made general manager, succeeding Mr. Jay P. Graves, who remains a vice-president of the company.

PERSONAL AND GENERAL

Mr. John R. Rutherford has resigned his position on the engineering staff of the Hollinger Gold Mines, Porcupine, Ont., to accept a position as superintendent at the Motherlode Gold Mine, Sheep Creek, British Columbia.

Graduates of the Michigan College of Mines who are located in the Cobalt district will meet at Haileybury on January 3 for the purpose of organizing an M. C. M. club.

Mr. C. A. Foster has returned from England, where he was successful in interesting capitalists in the Kirkland lake district, Ontario.

Mr. J. B. Tyrrell has returned from England.

Mr. Charles Fergie has been elected president of the Intercolonial Coal Co., succeeding Mr. D. Forbes Angus.

Mr. J. A. Dresser, manager lands department, Algoma Central and Hudson Bay Railway, announces that 2,000 square miles of the company's land are now open for public prospecting.

The Canadian General Electric Co. has issued a bulletin describing storage battery industrial and mining locomotives.

A meeting of the Toronto branch of the Canadian Mining Institute was held on December 13. The next regular meeting will be held on January 10.

The Smart Turner Machine Co., Limited, Hamilton, Ont., are supplying Messrs. Armstrong, Whitworth, of Canada, Ltd., Longueuil, Que., with one of their Duplex pumps.

The Toronto branch of the Canadian H. W. Johns-Manville Co., Limited, announces its removal to more spacious quarters at No. 19 Front street east. This new store and warehouse has a floor area of approximately 35,000 square feet, and is situated in the heart of the wholesale district.

COAL MINE ACCIDENTS IN THE UNITED STATES

The lack of comparable and accurate statistics of coal mine accidents in the United States has led the Bureau of Mines to collect such data, and the results of these investigations have been compiled by Mr. F. W. Horton, in Bulletin No. 69, entitled "Coal Mine Accidents in the United States and Foreign Countries," which has just been issued. This report shows that during 1912, 2,360 men were killed in the coal mines in the United States, as compared with 2,719 for 1911, and that the fatality rate was lowered from 3.73 in 1911, to 3.15 per 1,000 men employed in 1912. The report contains statistical information concerning the production, the number of men employed and the number of men killed in each State since 1896. From 1896 to 1907 the number of men killed per 1,000 employed gradually increased with only slight fluctuation, the number killed per 1,000,000 short tons also increased, but the rate fluctuated over a wider range.

During this twelve-year period through 1907, the increase in the death rate was accompanied by an enormous increase in the production of coal. In 1896 the output was 191,986,000 tons, and in 1907 it was 480,363,000 tons, an increase of over 150 per cent. In 1896 each man employed produced 2.64 tons coal per day, whereas in 1907 the daily production of each man was 3.06 tons, an increase of 16 per cent. Since 1907 there has been a marked decrease in the number of fatalities at the coal mines.

This general improvement has been brought about by a combination of causes, the principal one of which has been more efficient and effective mine inspection on the part of the State Mining Departments and the State mine inspectors throughout the country, supplemented by greater care on the part of both operators and the miners. The investigative and educational work of the Bureau of Mines has kept both the operator and the miner alive to the various dangers connected with coal mining, and has shown what precautions should be taken to avoid these dangers. As a result of these educational features, mining companies are organizing safety committees; providing emergency hospitals, training men in first aid and rescue work, so that in case of a disaster they are equipped to cope with any ordinary accident.

The fatality rates in a number of countries covering a period of ten years, 1901 to 1910, inclusive, are as follows:

Great Britain, 1.36 per 1,000 men employed; Germany, 2.11; France, 1.69; Belgium, 1.02; Japan, 2.92; Austria, 1.04; India, 0.96; New South Wales, 1.74; Nova Scotia, 2.65, while the rate for the United States was 3.74. The low fatality rates in some countries may be accounted for largely by reason of the fact that coal mine inspection has been in operation much longer than in the United States. In Great Britain the coal mine accident statistics have been collected, published and studied since 1851; France, 1853; Austria, 1875; Germany, 1852; and Belgium, 1831.

A chronological list of the more disastrous coal mine accidents in the United States shows that 275 accidents have occurred since 1839, in which five or more men were killed at one time, representing a total of 6,777 fatalities. Of these accidents there were 135 that killed from 5 to 9 men each, a total of 859; 82 that killed from 10 to 24 men each, a total of 1,237; 25 that killed from 25 to 49 men each, a total of 870; 18 that killed from 50 to 99 men each, a total of 1,221; 11 that killed from 100 to 199 men each, a total of 1,534; 3 that killed from 200 to 299 men each, a total of 695, and 1 that killed 361 men.

Of these larger disasters gas and coal dust explosions caused 183 accidents and 5,111 deaths, or over three-fourths of the total number of men killed. The next greatest number of deaths were from mine fires, which caused the loss of 1,082 lives, or over 15 per cent. of the total number killed, by 33 separate accidents. It may thus be seen that accidents from gas and coal dust explosions and mine fires account for more than 90 per cent. of the total number of men killed in these large accidents, although falls of roof, pillars and wall claim nearly 50 per cent. of the total fatalities.

ORE AND FUEL TESTING PLANTS.

The Mines Branch of the Department of Mines has installed at Ottawa a modern and well equipped laboratory—The Dominion of Canada Ore Dressing and Metallurgical Laboratory—for the purpose of experimental concentration and metallurgical tests with Canadian ores and minerals.

There are also ore testing plants at the principal mining schools in Canada, including the Nova Scotia Technical School, Halifax, N.S.; the University of McGill, Montreal; Kingston School of Mines, Queen's University, Kingston; and the University of Toronto, Toronto, Ont.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA AND ELK LAKE

To Drain Cobalt Lake.—Interests antagonistic to the draining of Cobalt lake have been reconciled to the scheme and there was little opposition before Mining Commissioner Godson at the hearing at Haileybury. A preliminary hearing was held in Toronto and most of the claims of the mining companies concerned were met and dealt with. At the last moment the Cobalt Board of Trade found that they will be put to heavy expense to construct sewers and other works necessary to take care of the sewage, which is now flowing into Cobalt lake. An agreement had been entered into with the town council of Cobalt, but this did not define the rights of the town in the matter and did not provide for a right of water for the sewer on the Cobalt Lake property. As a concession to the sentiment that was aroused another agreement was drawn up defining the rights of the town, it being conceded that the town would have to pay the cost of the sewers in return for the revenue to be derived from the ore tax on the Cobalt lake when it comes within the boundaries of the corporation of the town of Cobalt. There are a few other small claims yet to be satisfied, but, in the main, the way seems clear for the draining of the lake early next spring.

Kerr lake basin after removal of the water.
Caribou Cobalt (Drummond) buildings at left, Kerr Lake Co's property and pumping plant at right.

McKinley-Darragh-Savage.—The production for the month of November from the McKinley-Darragh and the Savage mines amounted to 187,800, as compared with 192,749 oz. in the preceding month. Of this the Savage contributed 58,008 oz., of which 42,000 was high grade and the remainder concentrates from the dump and development. The shoot of high grade ore found last month at the 140-ft. level of the Savage proved to be 60 ft. long. In the bottom of the winze 8 ft. below the level the vein is 2 in. wide of two thousand ounce ore.

The rich silver vein exposed as a result of draining Kerr lake.

Heavy low grade shipments from several mines, notably the Cobalt Townsite, in the month of November raised the gross tonnage from the camp higher than for any month in the past two years with the single exception of December of last year. The total shipments reached the figure of 2,170.10 tons from 15 mines.

The new Northern Customs mill is now dropping stamps and will take over the entire contract of the La Rose from the Cobalt Townsite mill before the new year. To construct and finish a mill in so short a time has broken all records in Eastern Canada at least. At the old Northern Customs mill, now the possession of the Cobalt Townsite, 100 stamps are treating Townsite ore and 20 stamps are dropping on City of Cobalt ore.

Right of Way.—In the second week in December the Right of Way shipped another car of concentrates. This is ore from the old Right of Way dump which is being treated in the Colonial mill.

The bullion shipments for the year have now passed the $5,000,000 mark. The Nipissing has produced more than two-thirds of the total.

Pan Silver.—More stock is being offered by the Pan Silver Mining Company in order to carry on development. At the annual meeting in Haileybury it was decided to issue 350,000 shares of treasury stock at 10 cents a share in order to carry on development on the property.

drifted on for 95 ft. The present west face shows but little vein and no values. The vein in the east face assays two thousand ounces over a width of one and a half inches. The average for the 95 ft. is about 1,500 oz. over one inch.

The hydraulicking operations have been discontinued for the season. All the work that is to be done on Nipissing property tributary to Cobalt lake has been done, and next spring the water will be taken from Peterson lake and will flow back into that lake.

The high grade mill treated 173 tons and shipped 516,857 ozs. of refined silver. The low grade mill treated 6,334 tons. The bullion from the Nipissing is again going to London owing to the express company having brought rates almost to the old level.

PORCUPINE, KIRKLAND LAKE, AND HARRICANAW

Hollinger.—Within the past month the Hollinger has done some very effective exploration with the diamond drill. In the face of the main vein at the 200-ft. level there has not been much ore for some time. As drills were so badly needed in other parts of the mine this face was left standing without much effort being made to pick up the extension, if there were extension. Recently one of the diamond drills which the Hollinger keeps for exploration work was set up in the drift and

Hollinger mine buildings and mill, Timmins, Ont.

Beaver.—The final payment has been made on the Beaver Auxiliary property at Elk lake by the Beaver Consolidated Company. A lack of water at the Elk lake prospect has handicapped development for some time; but a small lake in the neighborhood has now been dammed and the difficulty has been overcome.

At Gowganda the people refuse to be satisfied with the concession promised by the T. & N. O. Railway Commission in the way of a motor car service and an efficient telephone line. The Board of Trade passed a resolution asking for the extension of the railroad.

Nipissing.—During the month of November the Nipissing mined ore of an estimated net value of $159,220 and shipped from Nipissing and Customs ore an estimated net value of $367,153. At shaft 73 a crosscut at the fourth level continues to encounter extensions of branch veins showing at the third level. One was cut in October and two in November. Those found in November have widths of from one to two inches and assay two thousand ounces. These veins are within a few feet of the Keewatin contact. It is expected that they will increase in width and values when drifting is done on the conglomerate side.

A new vein was discovered at the third level of 64 shaft. This was found by a crosscut which will connect the third levels of shafts 64 and 73. The vein has been

a couple of holes drilled into the walls. About 20 ft. in the extension of the vein was cut. It has now been struck in the drift and shows ore not quite as wide as the average of the main vein, but much richer in grade. The use of the diamond drill in picking up extension of veins has been very successful on the Hollinger. The development of the subsidiary veins of the Hollinger has now reached a point where they are yielding a good portion of the daily tonnage of ore going to the mill. This accounts for the decrease in grade of the ore in the past two months. The smaller veins of the Hollinger are of lower grade than the No. 2, and it is therefore seen that the bigger the proportion of the ore that comes from their development the lower the grade to a certain point. At the present time the power plant of the Hollinger is not adequate for the growing needs of it and the Dixon. Another plant of a permanent nature has been planned and will be proceeded with at once. When this is finished it will take care of the Hollinger power needs for some time to come.

Dome.—Good progress is being made with the addition to the Dome mill, and it is expected that the first crushing of ore can be undertaken in April. As the returns made monthly now show the tonnage is gradually being raised until about 460 tons are being treated daily. The objective of the management is to mill a

thousand tons per day with the enlarged mill, but it is not expected that this end will be obtained until the whole of the eighty stamps have been dropping for some time.

Dome Lake.—It is reported that no time will be lost in starting up again at the Dome lake under the new management. The Timiskaming and Hudson Bay will inaugurate a vigorous development policy on the property they have just acquired.

North Thompson.—The Hamilton and Ehrlich interests on the North Thompson have two diamond drills at work and are sinking the old shaft. The vein, as it is being opened up, looks very promising. The Vipond, the adjoining property, is again being sampled, this time it is understood by the Hamilton and Ehrlich group.

Jupiter.—The bond issue of $50,000 on the Jupiter has all been subscribed by shareholders so that there is no necessity for an appeal to the outside public. The bonds are repayable in August of next year. The money so raised is to be used in paying off company obligations.

Kirkland Lake Proprietary, Ltd.—It is now announced that while in London, Mr. C. A. Foster succeeded in organizing the Kirkland Lake Proprietary, Ltd., a company capitalized at $1,000,000. This company will take over and operate claims in the Kirkland lake area. As Mr. Foster has a controlling interest in most of the best prospects in the new goldfields the new company will have no difficulty in securing prospects to take over and operate. The first prospect to be publicly announced as taken over is the Teck-Hughes gold mines, in which the Great Northern silver mines had a controlling interest. The English company has purchased 50,000 shares of treasury stock of this company and has an option on more of it. There will be no change whatever in the mine management. There is now a prospect of ample development money for the Kirkland lake field.

Harricanaw.—Interest in the Harricanaw field in Northern Quebec has been revived by the good surface ore found on the Sullivan claim. The vein on the Sullivan property has been opened up for several hundred feet and it is 5 ft. wide. A shaft has been put down 10 ft. and good assays have been obtained from sampling at the bottom of the test pit. The Sullivan claim is at Keniwisik lake, about 55 miles south of the Transcontinental Railway.

Wettlaufer.—After sinking two shafts to a depth of 50 ft. and doing some surface work, the Wettlaufer interests of Buffalo have decided to abandon operations on their veteran claims in Hoyle township, in the Porcupine district. The surface showing was promising, but values decreased as the shafts were sunk.

BRITISH COLUMBIA

BOUNDARY.

Phoenix.—The British Columbia Copper Co. has taken under option of purchase a mineral claim adjoining the Wellington group from which during recent years much oxidized ore was extracted and shipped to the smeltery at Greenwood. Prospecting work has been commenced to determine whether or not sufficient ore can be found to make it worth while resuming mining operations in this part of the camp. The Granby Consolidated Co. is reported to be diamond drilling on the Snowshoe property, formerly worked under lease by the Consolidated Mining and Smelting Co. Work on a small scale has been resumed on the Bay and Tip Top claims, west of Phoenix toward Greenwood. Gold-silver ore occurs on these claims, but production from them has not been of much importance in the past.

Greenwood.—The British Columbia Copper Co. is exploring ground at the south end of its Mother Lode property, in Deadwood camp, using a diamond drill. Indications are reported to be favourable to ore being found here. The Granby Consolidated Co. is stated to have bonded the Big Copper property, in Copper camp, five or six miles west of Greenwood, and to have commenced diamond drilling on it.

The Jewel 15-stamp mill has been operated continuously for the last five months, crushing and successfully treating monthly about 1,400 tons of gold-quartz. The Jewel-Denero Mines, Ltd., is about to sink the main shaft, now down 330 ft., to a greater depth with the object of opening another level at 100 ft. below the present lowest working. The mill plant was remodeled during the first half of this year. Since completion of the changes, about the end of June, there has not been any difficulty experienced in operating the mill.

"YARDAGE" DISPUTE AT COAL CREEK AND MICHEL*

It may be remembered that at the conclusion, in November, 1911, of the prolonged dispute between the members of the Western Coal Operators' Association and their employees, being members of the United Mine Workers' Association, it was agreed as from November 17, 1911, to March 31, 1915, that any dispute arising during the life of the agreement should be referred in writing (if not settled otherwise) "to the Commissioner of the Western Coal Operators' Association and the President of District No. 18, United Mine Workers of America, for settlement," these parties to select, if necessary, an independent chairman as third member, and, if a chairman being necessary, these parties were unable to appoint one by joint agreement, then an independent chairman to be named by the Minister of Labour. "The decision of the committee thus constituted shall be," says the agreement, "binding upon both parties."

Some time since a difference existing between the Crowsnest Past Coal Company, Limited, and its employees, with reference generally to the interpretation to be placed upon the term "yardage," and, the other members of the committee being unable to agree on an independent chairman, the Minister of Labour was requested to name a chairman. The Minister accordingly named Mr. James Muir, K.C., Calgary. The dispute has now been dealt with by the committee and has been formally passed upon. The Department has received during the month a copy of the decision reached, the same bearing the signatures of Mr. James Muir, chairman, and Mr. W. F. McNeill Commissioner of the Western Coal Operators' Association.

The decision of the committee was rendered in the following terms:—

This is an application of certain miners asking to be allowed what is known as "yardage," and on the 25th of March, 1913, the question came before myself as Chairman, appointed by the Minister of Labour, and Mr. Stubbs, representing the United Mine Workers, and Mr. McNeill, representing the Western Coal Operators' Association. After considerable discussion it was agreed by all parties that the consideration of this question should stand adjourned, and in the

*From Labour Gazette, November, 1913.

meantime Mr. McNeill and Mr. Stubbs should each file with me a brief or memorandum showing the grounds of their respective contentions.

On the 31st of said month of March, Mr. McNeill filed his argument, and on the 22nd September, ult., I received the argument put in by Mr. J. E. Smith, the delay of the latter argument being explained from the fact that in the meantime Mr. Stubbs had resigned from the position of President and Mr. Smith had succeeded him.

By the agreement between the Mine Workers and the Coal Operators, dated November 17th, 1911, provisions are made with great minuteness as to the charges to be made for the different mining operations under the different conditions existing in the various mines covered by that agreement, and among these provisions are what is known as "yardage."

In the mines belonging to the Crowsnest Pass Coal Company to which the mines in question belong, there are some sixteen provisions under the heading of "yardage" in all of which under this heading are included the following:—

(a) Levels and parallels.

(b) Crosscuts between levels.

(c) Room crosscuts no tracks,

and for these divisions of "yardage," different prices are allowed to miners in the different mines, and in two cases under that head the widths are given, and I may here notice that in the case of mines belonging to the International Coal & Coke Company, Limited, under the heading "yardage." divisions are made with prices and particulars differing from those in the first mentioned company. I would here note that this agreement which is to continue in force until the 31st of March, 1915, has apparently been prepared with great care and particularity, and no doubt in arriving at the different provisions fixed by this agreement concessions and compromises must have been made by both parties and the agreement having been reached under these circumstances it must have been intended during the time it was to be in force to settle the different questions as to prices for work done by miners as well as other matters so that any dispute arising between the parties interested should be governed by the agreement referred to.

At the first and only meeting held on the 25th March last, it was stated and it was not disputed, that the claim made by the miners here in dispute did not come within the terms of any of the sub-divisions of what is known as "yardage."

I have carefully read the arguments put in by Mr. Smith and Mr. McNeill, respectively, and I gather from Mr. Smith's argument that the meaning to be placed upon the provisions respecting "yardage" are to be extended from their ordinary meaning by reason of certain customs which support his contentions, and he, in support of this among other things, refers me to certain adjudications on this question of "yardage," the construction for which he contends was allowed, but I notice that these adjudications took place before the date of the agreement in question, therefore, it was a matter which had been in dispute before the agreement was entered into.

It is not contended but that apt words might have been used in the provisions respecting "yardage" which would have met the cases now in question and thus prevented any question being raised as to their meaning, and the fact that this same question had been a matter of dispute before the agreement leads me to the conclusion that for some reason or other it was not intended that claims for "yardage" should be extended beyond the provisions specially mentioned under that heading.

I may further say that in the discussion which took place on the 25th of March last, it was admitted by both parties that when this work was done by the miners in question, no agreement was made, nor has since been made, that the miners should be paid for their said work under the heading of "yardage." I must hold that both the mine workers and the mine operators understood or must be held to have understood that the rate of payment for this work in dispute was to be governed by the agreement hereinbefore referred to.

I may further say that I feel that it would be a serious matter and might endanger the rights of all parties if where express provisions are made these provisions are to be either extended or limited by doubtful interpretations put upon the words where the words used specify the particulars which in this case come under the head of "yardage."

I agree with Mr. McNeill in his conclusion that the miners' claims for "yardage" do not come within the terms of the written agreement referred to and should not be allowed, and I so find and award.

Dated at Calgary, Alberta, this 14th day of October, A.D. 1913.

(Sgd). JAMES MUIR,
Chairman.

I concur:
(Sgd.) W. F. McNEILL.

SULLIVAN ANGLE-COMPOUND AIR COMPRESSORS.

Angle-Compound engines have been used for many years under conditions demanding high speed, freedom from vibration and close economy, and some special air compressors of very large capacity have been built on the same principle. The Sullivan "Angle-Compound" may fairly claim, however, to be the only power-driven compressor of this design, now being manufactured in ordinary commercial sizes. In combination with other especial features, mentioned later in detail, the following marked advantages are obtained over compressors whose cylinders are in the same plane, as in the familiar duplex or cross-compound machines, whether horizontal or vertical.

The Angle-Compound design permits a very close balancing of reciprocating masses. The momentum of moving parts increases as the square of the rotative speed, and the matter of balancing is of larger economic importance for engines and compressors which are intended to run at comparatively high speed, than has generally been recognized. The perfect balance of the Angle-Compound compressor saves for useful work power otherwise wasted in friction and vibration. A coin will stand on edge on this machine when it is running at full load with the foundation bolt nuts removed. The compressor and motor will continue to run when unloaded for a minute and a quarter after the power has been shut off.

The output per unit of floor space has been increased —and this with an actual advance in accessibility of all parts and convenience of attention.

The small saving of floor space is accompanied by a reduction of strains on the foundation and the latter is of correspondingly small dimensions. No lining up beyond beveling need be done; no expensive or intricate problems in driving attachment need be solved, and hence installation cost, often a serious item in

other compressor types, is always a small matter in this machine.

The Angle-Compound compressor may be connected by any usual method to the motor unit which may be located at either end of the compressor. It may be direct connected, by mounting a motor or water wheel on its crank shaft. A wide range in the size of the band wheel is permissible, to accommodate various sizes and speeds of motor pulleys. A change of form, type or size of driving means may be made more easily and cheaply than with any other design.

Refinement in every detail, making for increased efficiency and durability, has been achieved for this design, as shown in the detailed description in the following pages.

The intercooler used is of extra size, effective in action, durable and convenient to repair. The use of the outside walls of the cylinder water jackets for cooling the air is a valuable addition of water cooled area that would otherwise be wasted.

The lubrication system is superior to the usual forms. A self-contained gravity system for working parts, a force feed system for cylinders and valves and compression grease cups on the valve motion, make a combination that insures perfect lubrication at all speed, eliminates oil drip or splash on outside parts and requires no drip pans.

With increased speed, the question of adequate and reliable lubrication becomes of greatest importance. The well-known splash system for supplying oil to the working parts, while simple and reliable, is not suited to fast-running engines and compressors. The oil used in this system is contained in the main frame, from which the most conscientious manufacturer is unable to remove every vestige of moulding or core sand and the gritty scale on the surface of the castings which is eventually dissolved by the oil. Even if all grit were removed in the manufacture of the machine, the erecting man or operator cannot be relied upon to thoroughly clean out all cinders and grit accumulated in transit or during erection. The constant and violent agitation of the oil by the moving parts keeps grit or foreign substance in the oil in suspension and delivers it repeatedly through the bearings, where, even if the grit is not harsh enough to cause heating, it produces unnecessary wear.

The oil reservoir in the Angle-Compound compressor is in the bottom of the horizontal frame, but the oil level is maintained at such a height that the moving parts do not touch it. Any gritty matter, therefore, remains undisturbed at the bottom. On the outside of the frame is attached a small plunger pump, operated from the valve gear, with all of its working parts submerged in the oil. This pump forces the oil into an elevated reservoir, whence it is distributed through piping to the bearings. Adjustable sight feed connections are provided, through which the oil flows in generous streams. The pump has a capacity largely in excess of requirements so that positive lubrication is assured. The excess oil is returned to the bottom of the horizontal frame through an overflow.

A separate system of lubrication is provided for the air cylinders in the form of a positive multiple feed oil pump actuated by connections to the air valve gear. This pump has sight feeds, so that the flow of oil is at all times under the observation of the operator.

The outboard bearing supporting the end of the crank shaft is independently lubricated by a supply of oil contained in a well underneath the bearing, to which it is delivered by ring oilers.

That compactness and accessibility can be brought together in the same unit has been demonstrated in this machine. Notwithstanding its enclosed and neat appearance, all working parts are easy to inspect, adjust or remove.

A single crank pin takes the place of the usual two eccentrics used for driving the valve motion in duplex machines. No supporting brackets or intermediate rocker arms are required.

A balanced disc on the end of the crank shaft carries a crank pin, on which the connecting rods for the valve motion of both cylinders are hung. It is unnecessary to point out the obvious simplicity and the many advantages of this arrangement as compared with the usual two eccentrics and eccentric straps with their high rubbing speeds and inconvenience of adjustment.

Balancing of Reciprocating Forces.—The reciprocating parts of a high-speed steam engine or compressor offer problems in balancing extremely difficult of satisfactory solution. Opposing balancing weights attached to the crank produce uniform opposing centrifugal forces radially around the shaft, while the inertia forces set up by the motion of the reciprocating parts change constantly in intensity throughout a revolution in line with their motion. They are started from a point of rest at one end of the stroke accelerated to maximum speed about mid-stroke, retarded from this point and brought to rest at the end of the stroke. In accelerating the reciprocating parts force has to be applied to them from the crank, tending to oppose its rotation, and they become charged, so to speak, with potential energy due to their velocity. After their maximum velocity has been reached at mid-stroke, and retardation begins to take place, the energy absorbed during the first half of the stroke is given up during the latter half, producing a force tending to assist the crank in its rotation.

In compressors of slow or moderate rotative speed, say 150 r.p.m., the disturbing effects of these inertia forces are so small that they are readily absorbed by the mass of the entire machine, but as the inertia varies as the square of the speed, it will be seen that if it is attempted to run such a compressor at a speed of 225 r.p.m. the disturbing effects have been increased in the ratio of $\left(\frac{225}{150}\right)^2 = 2.25$

In other words, with a speed increase of 50 per cent., the disturbing forces produced by the reciprocating parts have increased 225 per cent.

The inertia of the reciprocating parts reaches a maximum at the ends of the stroke and is equal in value to the centrifugal force of a mass having the same weight as the combined weight of the piston rod, crosshead and connecting rod. As stated above, the effect at the ends of the stroke is equivalent to the centrifugal force of a revolving mass of the same weight as the reciprocating parts, and the horizontal vibrations may be entirely neutralized by attaching such an equivalent weight to the crank opposite the crank pin. If this be done, however, the opposing centrifugal force of the revolving weight will practically neutralize the inertia forces, but introduce a new set of vertical unbalanced forces, of equal intensity, tending to shake the shaft and engine up and down.

In horizontal single or duplex compressors it will be seen that good balancing is an impossibility, and the best that can be accomplished is a compromise, effected by attaching a centrifugal counter weight of less weight than that of the reciprocating parts, which will partially absorb their horizontal disturbing effects without

introducing vertical unbalanced forces of injurious magnitude, leaving the bearings, frames and foundations to absorb the remainder.

In the Angle-Compound compressor the disturbing influences of the horizontal and the vertical members tend to offset or neutralize each other, the maximum unbalanced effects of the vertical parts being produced when those of the horizontal parts are at minimum value and vice versa.

The beneficial effects of reduction in forces tending to set up vibrations are manifold. One of the main obstacles to high rotative speed having been removed in this design, a smaller machine may be used for a given duty, provided it is designed with proper values and valve areas for its rated speed, thereby involving savings in original investment, space requirements and foundations.

The massive foundations necessary to absorb the unbalanced vibrations in other types are not required for the perfectly balanced Angle-Compound compressor, and it may be successfully operated in buildings where vibration is objectionable or on unstable or filled ground, where vibration would have a tendency to cause unequal settlement and throw the compressor out of alignment.

The heavy counterweight permitted by this design practically absorbs within the shaft itself all of the heavy inertia loads, which would otherwise have to be carried by the crank shaft bearings, and leaves these important elements of the compressor free to perform their proper function of carrying the load due to the air pressure on the pistons and to support the weight of the moving parts, thereby greatly reducing power losses due to friction, trouble with heated bearings, etc.

In addition to the elimination of inertia loads from the bearings a further benefit is gained by a more uniform distribution of the working pressures around the circumference of the crank shaft boxes. In the horizontal type of machine, the wear due to the influence of piston load is all on the sides of the boxes, while with the Angle-Compound type the piston load produces wear in both horizontal and vertical directions, with the result that the boxes require less adjustment, with the wear distributed over a greater surface, and both the shaft and boxes retain a more nearly cylindrical shape throughout their life, resulting in unusual freedom from pounding.

In the ordinary duplex design, the stresses due to piston load are applied to the ends of a crank shaft supported in bearings several feet apart, and as the piston loads, during certain parts of the revolution act in opposite directions, a twisting effect or couple is set up in a horizontal plane which must be resisted by the machine frame, the foundations or both. Any lack of rigidity in these elements disturbs the alignment and produces a tendency toward heated bearings and increased friction. In foundations for duplex compressors, which are necessarily of large horizontal dimensions, if any settlement occurs, it is bound to be unequal and the wide base or frame cannot be made stiff enough to resist the distorting forces of the settling foundation. The right-angle compressor foundation is short and narrow, and if settlement occurs, the foundation, in tilting from a level position, will move as a solid block or unit, and no distortion of the frame will result. Furthermore, the right angle frame is short, narrow and of great depth in comparison to its width, giving it a rigidity far in excess of that found in the broad and more flexible base supporting the duplex compressor.

The unique arrangement of the cylinders in the Angle-Compound compressor permits the location of both connecting rods side by side on the same crank pin. This feature reduces the distance between the centre lines of the two cylinders from several feet in the duplex to the width of one connecting rod box in the Angle-Compound type, and practically eliminates the severe distorting forces previously referred to.

The crank shaft is supported in large bearings immediately on either side of the crank pin, so that the load imposed by both pistons is borne equallly by these bearings, without any tendency to rock or spring the shaft or main frame.

A PORTABLE SUB-STATION FOR A COAL MINE.

The Berwind-White Coal Mining Company, Windber, Pa., has recently added a 400 kilowatt Westinghouse portable sub-station to its equipment and is making a very interesting use of it.

A sub-station consists of apparatus for changing alternating current into direct current, and is generally necessary in mining work because direct current must be used for haulage in mines, but cannot be transmitted economically over long distances. Hence, when the

mine is located some distance away from the power station that serves it electric power can be transmitted more efficiently as alternating current at a high voltage and then transformed to direct current in the sub-station.

The Berwind-White Company is developing its outlying properties very rapidly and needs direct current at points where permanent sub-stations are not yet erected. In order to prevent delays in the development the use of a portable sub-station was decided on.

This sub-station has the same equipment that a permanent installation has; namely, transformers to step down to a moderate value the high voltage of the current received from the transmission line, a switchboard, and a rotary converter, which receives alternating current and delivers direct current. This apparatus is mounted in a car resembling an ordinary freight car.

When the work at a new development reaches the point where direct current is necessary the portable sub-station is hauled out to the workings, connected to the alternating current transmission system, and is started to work generating direct current. When the permanent sub-station is built the portable one becomes unnecessary and is taken to the next development.

A further use of this sub-station is to provide insurance against shut-downs. If accidents occur at any of the permanent sub-stations, the portable outfit is sent to carry the load until repairs are completed. One portable sub-station, therefore, is practically the equivalent of a duplicate set of apparatus at each permanent sub-station.

POWER EQUIPMENT FOR WINDSOR HOTEL.

The power equipment for the new Windsor Hotel, designed and installed under the supervision of Mr. Kelsch, consulting engineer, is more complete than usual because of the problems to be met. The power plant, which is in charge of Mr. Winkworth, chief engineer of the Windsor Hotel Co., is one of the most up-to-date isolated power plants in Canada. The main object of the power plant is to furnish light and heat to the hotel and power for the various motors used in the laundry, for ventilating fans, and in other parts of the hotel.

The steam equipment consists of three 200 h.p. Robb water tube boilers, each with a heating surface of 2,143 square feet. Two of the boilers are set in a battery and one is installed singly. The boilers, which are built for 175 pounds working pressure, are equipped with cotton blowers for burning anthracite screenings. This type of boiler consists of two horizontal cross drums with headers which are connected by a main bank of inclined tubes. The drums are connected by two rows of horizontal tubes, which complete the path of circulation for the water. At the extreme top, superheating tubes connect the drums so that the steam, which is separated in the front drum is thoroughly dried and slightly superheated when it enters the rear drum, from which it is piped to the engines.

This boiler is distinguished from other water tube boilers by the large throat area where the front header joins the front drum, giving a free and unrestricted passage for the large volume of water and steam passing from the main bank of inclined tubes into the drum. As the drums extend crosswise and the headers are as wide as the length of the drum, there is no contraction at the throat, as is necessary in many types where longitudinal drums are used.

Great flexibility is another feature of this new boiler, not only from the way it is placed in the setting on the supporting framework, but also because of the construction of the boiler itself. All the tube surfaces run in one direction and the plate surfaces in another, thus eliminating the strains caused in boilers where the longitudinal drums, headers, and tubes are connected rigidly together. A thoroughly modern design, this boiler has ample provision for cleaning, a hand-hole being placed in the header opposite each tube.

In the engine room of this power plant there are installed three Robb vertical compound engines, which are run non-condensing. Each engine is direct-connected to a 150 k.w. electric generator, made by the Canadian Westinghouse Co. These engines will operate the generators at 25 per cent. overload for two hours and 50 per cent. overload for one hour. With steam at 150 pounds pressure, they will carry the normal load at a speed of 425 r.p.m. These engines are entirely enclosed, so that working parts are protected from accident, and there is no danger of oil being thrown about the engine room. Every revolving and sliding part is automatically lubricated by a system which consists of a pump and distributing pipes, in which a pressure of from 10 to 20 pounds per square inch is maintained. Of the vertical type, these engines have many features which have been very successful in marine practice, and modified for stationary practice enable the engines to maintain the speed desired for direct connection.

A fuel testing station has been established by the Mines Branch at Ottawa, the Dominion of Canada Fuel Testing Plant, to demonstrate that peat could be economically utilized as a fuel for power purposes in a producer gas power plant, and to test the fuel and power producing values—on a commercial scale and in a commercial gas producer—of the bituminous coals of the extreme eastern and western provinces and of the lignites of Manitoba, Alberta and Saskatchewan.

A plant is also about to be erected by the Government of the Province of Saskatchewan at Estevan, for the purpose of assisting the development of the coal mining industry by testing the lignite coal of that district.

COBALT SHIPMENTS

The shipments for the week ending December 19 were again over one million pounds, including a car of high grade from the Casey Cobalt. The Nipissing shipped no less than five cars of cobalt residue from the high grade mill to England and the rise in the price of cobalt on the European market will make that mineral worth something to Cobalt mines in the future, perhaps. Of the six mines shipping two contributed low grade, namely, Nipissing and La Rose, the latter company also sending out a car of concentrates. The bullion shipments were well up to average, though of the three companies shipping, Nipissing alone ran over the 50,000 ounce mark. The Nipissing has now shipped in bullion over six million ounces.

The ore shipments from the Cobalt mines for the week ending December 19, were:

	High.	Low.	Lb.
Caribou Cobalt	59,960	.....	59,960
Cobalt Lake	125,130	.....	125,130
McKinley-Darragh	257,310	.....	257,310
Nipissing	.....	370,740	370,740
La Rose	86,680	60,000	166,680
Casey Cobalt	55,507	.....	55,507
	584,587	450,740	1,035,327

The bullion shipments were:

	Bars.	Oz.	Value.
Nipissing	115	134,807.58	$77,851.38
Dominion Reduction	18	20,358.00	12,011.22
Penn-Can.	6	4,155.30	2,410.07
	139	159,320.88	$92,272.67

—Cobalt Nugget.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

Dec. 23, 1913.

New York Curb.

	Bid.	Ask.
Alaska Gold	21.37	21.62
British Copper	2.12	2.37
Braden Copper	7.00	7.12
California Oil	265.00	270.00
Chino Copper	38.12	38.37
Giroux Copper	.75	1.25
Green Can.	6.00	6.50
Miami Copper	21.12	21.25
Nevada Copper	15.12	15.25
Ohio Oil	145.00	146.00
Ray Cons. Copper	17.87	18.12
Standard Oil of N. Y.	177.00	178.00
Standard Oil of N. J.	400.00	402.00
Tonopah Mining	1.62	1.75
Tonopah Belmont	7.12	7.31
Tonopah Merger	.51	.52
Inspiration Copper	14.50	14.75
Goldfield Cons	1.37	1.43
Yukon Gold	2.00	2.12

Porcupine Stocks.

	Bid.	Ask.
Apex	.00½	.01
Dome Extension	.06½	.07
Dome Lake	.23	.24
Dome Mines	14.80	15.10
Eldorado	...	.01
Foley O'Brien	.15	.20
Hollinger	16.90	17.20
Jupiter	.06½	.07
McIntyre	1.50	1.55
Moneta	.02	.04
North Dome	...	.40
Northern Exploration	1.25	1.50
Pearl Lake	.09½	.09¾
Plenaurum	...	.40
Porcupine Gold	.10¾	.11¼
Imperial	.01½	.02
Porcupine Reserve	...	.06
Preston East Dome	.01	.02
Rea	.15	.20
Standard	...	.01
Swastika	.04¾	.05
United	...	.01
West Dome	.06	.10
Porcupine Crown	1.25	1.28
Teck Hughes	...	.28
Caribou	.67	.71

Cobalt Stocks.

	Bid.	Ask.
Bailey	.05	.05¼
Beaver	.30½	.31
Buffalo	1.75	1.80
Canadian	...	.16
Chambers-Ferland	.15½	.16
City of Cobalt	.30	.35
Cobalt Lake	.45	.53
Coniagas	7.15	7.25
Crown Reserve	1.70	1.71
Foster	.06	.08
Gifford	.02¾	.03
Gould	.02¾	.03
Great Northern	.09	.10
Hargraves	.02	.03
Hudson Bay	67.00	71.00
Kerr Lake	4.45	4.50
La Rose	1.99	2.00
McKinley	1.00	1.02
Nipissing	7.90	7.95
Peterson Lake	.25½	.26
Right of Way	.04½	.06
Rochester	.02	.03
Leaf	.01	.02¼
Cochrane	...	.40
Silver Queen	.04	.06
Timiskaming	.13	.14
Trethewey	.25	.30
Wettlaufer	.06	.08
Seneca Superior	2.00	3.00

TORONTO MARKETS.

Dec. 23—(Quotations from Canada Metal Co., Toronto).
Spelter, 5 cents per pound.
Lead, 5½ cents per pound.
Tin, 40 cents per pound
Antimony, 8½ cents per pound.
Copper, casting, 15½ cents per pound.
Electrolytic, 15½ cents per pound.
Ingot brass, 10 to 15 cents per pound.

Dec. 23—Pig Iron—(Quotations from Drummond, McCall & Co., Toronto.)
Summerlee No. 1, $26.00 (f.o.b. Toronto).
Summerlee No. 2, $25.00 (f.o.b. Toronto).

Dec. 23—Coal—(Quotations from Elias Rogers Co., Toronto).
Anthracite, $8.25 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

Dec. 19—Connellsville coke (f.o.b. ovens).
Furnace coke, prompt, $1.75 per ton.
Foundry coke, prompt, $2.50 to $2.75 per ton.

Dec. 19—Tin, straits, 37.15 cents.
Copper, Prime Lake, 14.50 to 14.75 cents.
Electrolytic copper, 14.12½ to 14.37½ cents.
Copper wire, 15.50 cents.
Lead, 4.00 cents.
Spelter, 5.15 to 5.20 cents.
Sheet zinc (f.o.b. smelter), 7.25 cents.
Antimony, Cookson's, 7.40 to 7.50 cents.
Aluminum, 18.50 to 19.00 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $43.00 to $44.00 per ounce.
Platinum, hard, 10 per cent., $46.00 to $47.50 per ounce.
Platinum, hard, 20 per cent., $49.00 to $51.50 per ounce.
Bismuth, $1.95 to $2.15 per pound.
Quicksilver, $39.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
Dec. 11	57⅞	26¾
" 12	58	26 13/16
" 13	58	26 13/16
" 15	57⅝	26⅝
" 16	57⅝	26⅝
" 17	57⅝	26 11/16
" 18	57¾	26 11/16
" 19	58	26 13/16

FOR SCREENING AND CONVEYING COAL

INSTALL

"THE MARCUS"

HORIZONTAL SYSTEM

And Simplify Your Screening, Picking, Mixing and Loading Arrangements

WRITE FOR FULL PARTICULARS

"THE MARCUS" Combines Shaker Screen and Picking Table, thus Economizing in First Cost.

"THE MARCUS" is especially adapted for Fragile Coal, reduces breakage to a minimum.

"THE MARCUS" will convey 320 tons per hour and only absorb 7 horse power.

"THE MARCUS" screens out small to facilitate efficient picking, yet can be mixed with large at delivery end for Mine Run Coal.

"THE MARCUS" horizontal system greatly reduces the height of structure.

"THE MARCUS" system makes it possible to meet the varying demands of the market by enabling the different sizes of coal to be mixed.

SOLE RIGHTS FOR CANADA

HEAD, WRIGHTSON & CO., LTD.

CONSULTING ENGINEERS, MANUFACTURERS AND CONTRACTORS

ENGLAND, CANADA, SOUTH AFRICA AND AUSTRALIA

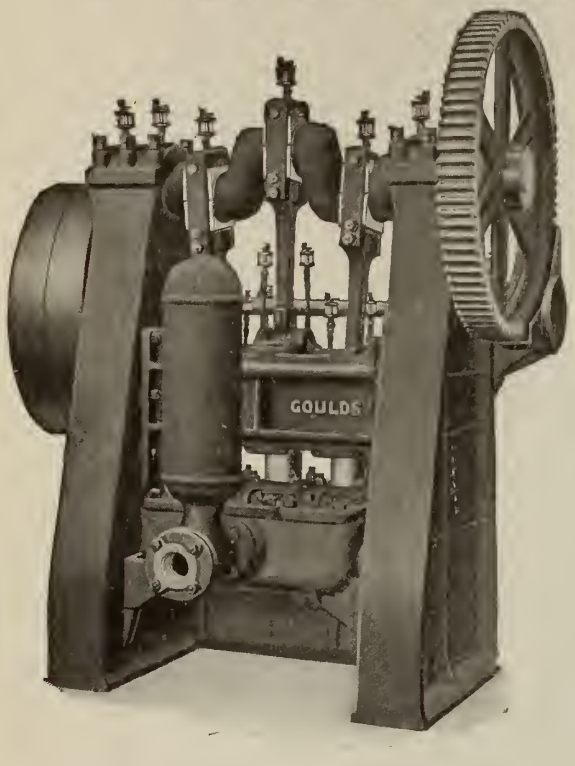
THE SOLE RIGHTS FOR THE UNITED STATES OF AMERICA ARE HELD BY MESSRS. ROBERTS AND SCHAEFER COMPANY OF CHICAGO

SPECIALTIES

The Marcus Screen, Conveyor and Washer. Complete Mine Equipment.
Coal Shipping, Gas Works Plant. Metalliferous Mining Machinery.
Cement Works Conveyors.

CANADIAN OFFICES:—84 MOSS STREET, VICTORIA, B.C.

DESIGNS AND QUOTATIONS FREE



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam Shovels**: **Specially Flexible** Ropes for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:--

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. **New Brunswick: W. H. Thorne & Co., Ltd., St. John.**
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, G. W.
Campbell & Deyel.
Carter, W. E. H.
Demorest, Stull & Low
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Forbes, H. L.
Graham, S. N.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Leckie, J. E.
Loring, F. C.
McEvoy, Jas.
Scott, O. N.
Segsworth, Walter E.
Smith, Alex H.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.
Woolsey, W. J.

British Columbia

Ashworth, James
Fowler, S. S.

FOREIGN-New York

Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Campbell & Deyell
Heys, Thos. & Son.

Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd

Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASHWORTH, JAMES
MEMB. S. W. I. E.
Consulting Mining Engineer,
General Manager Crows Nest Pass Coal Co. 1909—1911
1109 Hornby St. VANCOUVER, B. C

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M. 5199, Code: Bedford McNeill

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place.
New York City

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FORBES, H. L. M.Sc.,
Mining Engineer
77 Sparks Street., OTTAWA, CAN
Specialty: Mica Phosphate.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

JOHNSON, W. S.
Phones { Office Main 6935 / Res Lachine 218
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LECKIE, J. EDWARDS,
Mining & Consulting Engineer,
Box 1555. - - Vancouver, B.C.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY JAMES
Mining Engineer,
Stair Building,
TORONTO.

MACARTHUR, J. S. & CO.,
of LONDON & GLASGOW
Mining Engineers and Metallurgists,
PORCUPINE, ONT.
Represented by
Wm. Thornton, A. I. M. M.
Geo. P. Dempster.

MCMEEKIN, A., B. Sc. O. L. S.
Mining Engineer and Ontario Land Surveyor
Mines and Mining Properties examined and reported upon
KENORA - - ONTARIO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

O. N. SCOTT, B. Sc.
MINING ENGINEER
DOMINION BOND BUILDING
(*Cor. King and Yonge Sts.*) TORONTO
Tel. Main 1585 Cable Address "Onscott"

MAURICE W. SUMMERHAYES
Mining Engineer,
McENANEY MINES
Schumacher P.O., - Ont.

SMITH SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

THOMAS, KIRBY
Mining Engineer
Examination and Valuation of Mining Properties
20 Broad St., Suite 1017, Annex, New York
Cable Address: "Kirthom," New York.
Code: Bedford-McNeill.

WALKER, T. L.
Geologist
Reports on Molybdenum and Tungsten Properties.
University of Toronto, TORONTO

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES
LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

MINING PROPERTY FOR SALE
Gold Mining Claim, surrounded by very rich Mining Properties, near Kirkland Lake. Will sacrifice 25% of value for cash. The greatest opportunity ever offered.
Information promptly given. Apply, Box 9, CANADIAN MINING JOURNAL.

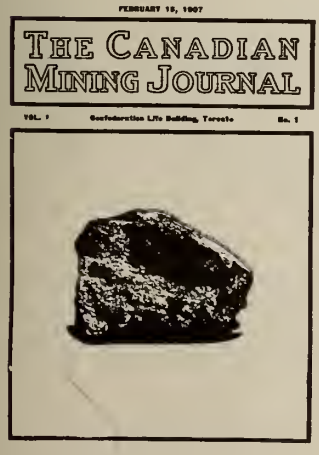
HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Smith & Travers Diamond Drill
Company, Limited
Box 12, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

POSITION WANTED
Mechanical Construction Engineer and Draughtsman, experienced Designer and Erector of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc., seeks position. References.
Apply Box 8,
CANADIAN MINING JOURNAL
TORONTO

WANTED
Wanted a first-class Engineer to give valuation, and make a general report on Gold Mining Claim.
Apply with terms, Box 10,
CANADIAN MINING JOURNAL.

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL



The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....

Address .....

.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

1085. Descriptive Sketch of the Geology and Economic Minerals of Canada. Accompanied by a geological and mineral map of Canada, by G. A. Young and R. W. Brock.

NEW BRUNSWICK and NOVA SCOTIA

1165. Memoir No. 18. Bathurst District, New Brunswick, by G. A. Young. Maps not yet published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1160. Memoir No. 17. Larder Lake District, Ont., and Adjoining Portions of Pontiac County, Quebec, by Morley E. Wilson.
1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1220. Memoir 29. Oil and gas prospects of the Northwest Provinces of Canada, by Wyatt Malcolm. Map not yet published.

BRITISH COLUMBIA

1206. Memoir No. 26. Geology and Mineral Resources of the Tulameen District, B.C., by Charles Camsell.
1255. Memoir No. 37. Portions of Atlin District, British Columbia, with Special Reference to Lode Mining, by D. D. Cairnes.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1042. Mineral Map of Canada. Scale 100 miles to 1 inch.
1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NOVA SCOTIA

1133. Map 13A. Kingsport sheet, Nova Scotia, No. 84. Scale 1 mile to 1 inch.
1208. Map 53A. Southeast Nova Scotia. Scale 4 miles to 1 inch.

NEW BRUNSWICK

1181. Map 35A. Reconnaissance Map of Parts of Albert and Westmoreland Counties, N.B. Geology and topography. Scale 1 mile 1 inch.

QUEBEC

1178. Map 32A. Larder Lake and Opasatika Lake, Nipissing, Abitibi and Pontiac, Ontario and Quebec. Geological. Scale 2 miles to 1 inch.

ONTARIO

750. Grenville Sheet. Parts of Counties of Ottawa, Argenteuil, Terrebonne, Two Mountains and Vaudreuil, Quebec and Carleton, Russell, Prescott and Glengarry, Ontario. Geology. Scale 4 miles to 1 inch. Reprint.
1177. Map 31A. Larder Lake, Nipissing District, Ontario. Geology. Scale 1 mile to 1 inch.
1244. Map 64A. Advance geological copy of map of Gowganda Mining Division and vicinity. Scale 1 mile to 1 inch.

ALBERTA

1132. Map No. 7A. Bighorn Coal Area, Alberta, by G. Malloch. Scale 2 miles to 1 inch.

BRITISH COLUMBIA

1260-1276. Maps 74A-90A. Geology of the Forty-ninth Parallel. Geology and topography of the International Boundary between British Columbia and the United States. Scale 1 mile to 1 inch, contour interval 100 feet.
1283. Map 94A. Taku Arm, Atlin District, B.C. Geology. Scale 4 miles to 1 inch.

YUKON and NORTH WEST TERRITORIES

1089. Map 9A. Explored Routes on parts of the Albany, Severn and Winisk Rivers. Scale 8 miles to 1 inch.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

The John Inglis Co.,

LIMITED

Engineers and Boilermakers

SOME OF THE PRODUCTS OF OUR SHOPS

We Manufacture

Boilers of all Kinds
Engines of all Kinds
Pumping Machinery
Steel Tanks
Heavy Plate Work
Special Machinery

WRITE US

14 Strachan Avenue TORONTO Canada

A. ANGSTROM, *Montreal Representative,* Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF . . . . . **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners

BUYERS OF SILVER---COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario
Branch Office: - - 806 Lumsden Building
Cor. Adelaide and Yonge Sts., Toronto

MOLYBDENITE

90% PURE

WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of

Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

PHILIPP BROTHERS,

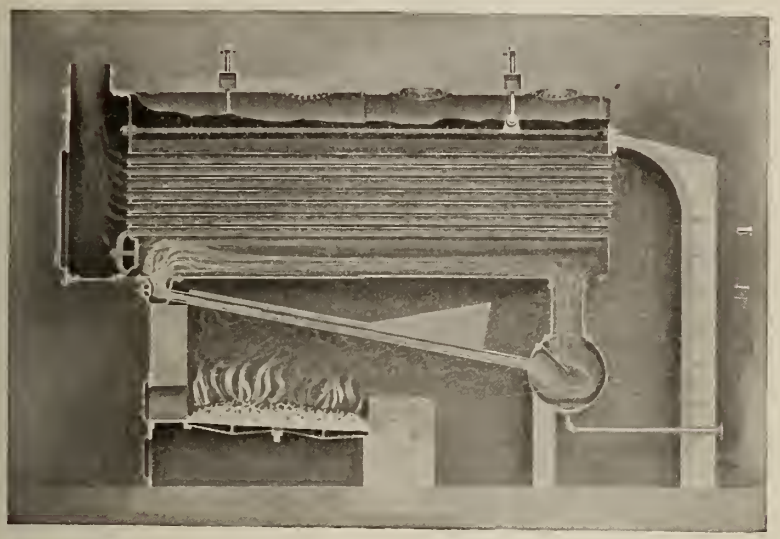
133 Fenchurch Street, London, E.C.,

are always buyers of

REFINED BLACK OXIDE OF COBALT

THE BARROW BOILER

A COMBINATION FIRE AND WATER TUBE CONSTRUCTION



At the rear of the boiler there will be noticed a large drum, designed to take care of mud and scale. As the water circulates down the back connection, mud and other sediment will collect in the bottom of this drum and can be blown off at the engineer's convenience. The drums are so built that there are no hand holes or plugs in the fire.

One user writes :—"We find the mud drum arrangement on the No. 2 boiler a great mud remover and a great scale reducer. With either one of these two boilers we find we are able to run our brewery and produce 40 tons of ice in our ice plant per day with but very little coal more than used to require to operate our brewery plant alone, with the other two boilers which we removed."

CANADIAN ALLIS-CHALMERS, LIMITED

HEAD OFFICE : TORONTO. DISTRICT SALES OFFICES : MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER, PRINCE RUPERT,

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $10 an acre for SUPERIOR METALS when more than 20 miles distant from a railway and $20 an acre when less than 20 miles.

For INFERIOR METALS the prices are $2.00 and $4.00 an acre respectively.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co..... 22
Amatite Roofing 13
American Diamond Rock Drill Co. 16
Ashworth, James. 23
Astley, J. W..... 23

B

Bartlett, C. O., & Snow Co..... 17
Bath, Henry & Son..... 28
Beatty, M. & Sons, Ltd..... 11
Bennet, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons..... 16
Blackwell, Geo. G., Sons & Co.... 28
British Columbia, Province of.... 15

C

Canadian Allis-Chalmers, Ltd. ... 29
Campbell & Deyell..... ..23 and 25
Canadian Bag Co..... 13
Canadian Bank of Commerce..... 8
Canadian Cleveland Drill Co..... 9
Canadian Copper Co..... 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Laboratories, Ltd..... 25
Canadian Northern Steamships ... 7
Canadian Ingersoll-Rand Co., Ltd. 3
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Capell Fan Co..... 16
Carter & Smith..... 23
Castellanos, A. W..... 16
Cohen, S. W..... 23
Colvocoresses, G. M..... 23
Consolidated Mining & Smelting Co. 28
Coniagas Reduction Co., Ltd..... 28
Curtis's & Harvey.....
.....Outside back cover

D

Dept. of Mines, Canada..... 26
Deister Machine Co. 14
Delbro Mining & Reduction Co.... 28
DePencier, H. P..... 23
Diamond Drill Contracting Co.... 16
Dominion Coal Co., Ltd..... 8
Dominion Bridge Co..... 16
Donald, Dr. J. T..... 25
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W..... 23

F

Ferrier, W. F..... 23
Fleck, Alex. 7
Flory, S., Mfg. Co..... 12
Forbes, H. L..... 24
Forbes, D. L. H..... 23
Fowler, S. S..... 23
Fraser & Chalmers, Ltd..... 4
Federal Engineering Co., Ltd. ... 31

G

Graham, S. N..... 23
Gray, John. 25
Greening, B., Wire Co., Ltd..... 10
Gwillim, J. C..... 23

H

Hadfield's Steel Foundry Co. 6
Handley, John. 24
Hardman, J. E..... 24
Hassan, A. A. 23
Haultain, H. E. T..... 24
Hersey, Milton Co., Ltd..... 25
Heys, Thos. & Son..... 25
Hille, F. 24
Holman Drill Co..... 20
Head, Wrightson & Co., Ltd..... 21

I

Inglis, John & Co., Ltd..... 27
Imperial Bank of Canada 2
Industrial & Technical Press..... 39
International Nickel Co. 8
International Engineering Works, Ltd. 11

J

James Ore Concentrator Co.....
.....Outside back cover
Jeffrey Mfg. Co., Ltd. 19
Johnson, W. S..... 24
Jones & Glassco..... 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co..... 25
Leckie, J. Edwards..... 24
Loring, F. C..... 24
Lymans, Limited. 9
Lands of the Algoma Central and Hudson Bay Ry..... 36

M

Morton, B. K. & Co..... 18
MacArthur, J. S..... 24
McEvoy, James 24
McMeekin, A. 25
Mussens, Limited. . . ..
.....20 and front cover
Michigan College of Mines 7

N

Nova Scotia Steel & Coal Co..... 10
Nova Scotia, Province of..... 15
Northern Canada Supply Co., Ltd. 7
Northern Electric & Mfg. Co., Ltd. 5

O

Orenstein-Arthur Koppel Co..... 5
Oxford Copper Co. 8
Ontario, Province of 30

P

Paterson Mfg. Co..... 13
Peacock Bros. 6
Pyke, Jas. W. & Co., Ltd. 17
Philipp Bros. 28

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31

S

Stanley, W. F. & Co., Ltd..... 12
Schaaf-Regelman, E. 28
School of Mining, Kingston..... 13
Scott, O. N. 24
Segsworth, W. E..... 24
Smart-Turner Machine Co..... 12
Smith & Duskee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd.....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Sullivan Machinery Co..... 2
Summerhayes, Maurice W..... 24
Swedish Steel & Importing Co., Ltd. 12

T

Toronto University 2
Tyrrell, J. B..... 24
Thomas, Kirby 24
Timiskaming & Northern Ontario Ry. 18

W

Waterous Engine Works Co., Ltd. 9
Willmott, A. B..... 24
Walker Bros. 6

Lanco Balata Belting

This belt has no equal in service giving qualities where the conditions change from wet to dry. It is equally reliable for all conditions except those of heat. It is made intensely strong and is impregnated by our own secret process with PURE balata gum. Write for booklet "The Main Drive."

Federal Engineering Co., Limited
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt, Ont.
Ledoux & Co., 99 John St., New York.
Thos. Hayes & Son, 124 onge St., Toronto.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Ball Mills—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Mussens, Limited.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried.A. G., Germany.
Mussens, Limited.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Limited.
Northern Canada Supply Co.
Jones & Glassco.
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineers Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd.
Thomas & William Smith.
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada), Limited.
Mussens, Limited.
Northern Canada Supply Co.

Blowers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried.A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.

Blast Furnace Plant—
Head, Wrightson & Co, Ltd.

Boilers
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
Canadian Ingersoll-Rand Co., Ltd.
The John Inglis Co., Ltd.

Buckets—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Limited.
Northern Canada Supply Co.

Buildings—Steel Frame
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd.

Cable — Aerial and Underground—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Limited.
Mussens, Limited.

Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Limited.
Northern Canada Supply Co.

Cables—Wire—
Standard Underground Cable Co. of Canada, Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co

Cement Machinery—
Canadian Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.
Head, Wrightson & Co, Ltd.

Chains—
Jeffrey Mfg. Co.
Peacock Brothers.
Jones & Glassco.
Mussens, Limited.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.

Chemists—
Canadian Laboratories.
Campbell & Deyell.
Thos. Heys & Son.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Limited.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd

Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Jeffrey Mfg. Co.
Head, Wrightson & Co., Ltd.

Coal Punchers—
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Limited.
Peacock Brothers.
Head, Wrightson & Co., Ltd.

Compressors—Air—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd.
Laurie & Lamb.
Canadian Westinghouse.
Can. Ingersoll-Rand Co., Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs.
Canadian Allis-Chalmers, Ltd.
Diester Machine Co.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Canadian Allis-Chalmers, Ltd.
Peacocks Brothers.
Mussens, Limited.
Northern Canada Supply Co.

Condensers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Brothers.
Laurie & Lamb.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.

Conveyors—Belt—
Head, Wrightson & Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Brothers.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Waterous Engine Works.
Canadian Fairbanks-Morse. Co., Ltd.

Cranes—
SmartTurner Machine Co.
Peacock Brothers.
Mussens, Limited.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Crushers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Lymans, Limited.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Hadfields Steel Foundry Co.

Cyanide Plants—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Roessler & Hasslacher.
Mussens, Limited.
Thomas & William Smith.
Peacock Brothers.

Derricks—
Smart-Turner Machine Co.
S. Fiory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Limited.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons.
Mussens, Limited.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Brothers.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Standard Diamond Drill Co.

Drills—Diamond.
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Canadian Ingersoll-Rand Co.
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Siemens Co. of Can., Ltd.
Canadian Ingersoll-Rand Co.

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Limited.
Orenstein-Arthur Koppel Co.

Dynamite—
Curtis & Harvey (Canada). Limited.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Can. Wostinghouse Co.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Ejectors—
Mussens, Limited.
Peacock Brothers.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Elevators—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Peacock Brothers.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Brothers.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Roberts & Schaefer Co.
Head, Wrightson & Co, Ltd.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Brothers.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Mussens, Limited.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Brothers.
M. Beatty & Sons.
Canadian Westinghouse.
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Brothers.
The John Inglis Co., Ltd.
Can. Fairbanks-Morse Co.

Engines—Oil—
Peacock Brothers.
Can. Fairbanks-Morse Co.

Engines—Steam—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Mahine Co.
Robb Engineering Co.
S. Fiory Mfg. Co.
Alex. Fleck.
Peacock Bros.
M. Beatty & Sons.
Laurie & Lamb.
Mussens, Limited.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers. Ltd.
Sullivan Machinery Co.
Peacock Brothers.
Mussens, Limited.

Feeders—Ore—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Mussens, Limited.

Filters—
Krupp, Fried, A. G., Germany.

Forges—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co. Ltd.

Forgings—
M. Beatty & Sons.
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Brothers.

Furnaces—Assay—
Krupp, Fried, A. G., Germany.
Lymans, Limited.
Mussens, Limited.

Fuse—
Peacock Brothers.
Curtis & Harvey, (Canada). Limited.
Canadian Westinghouse.
Canadian Explosives.
Mussens, Limited.
Northern Canada Supply Co.

Gears—
Canadian Westinghouse.
Krupp, Fried, A. G., Germany.
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada., Ltd.

Girders—Steel—
Dominion Bridge Co.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :					Halifax
QUEBEC :					Montreal
ONTARIO :	Toronto,	Cobalt,	South Porcupine,	Port Arthur,	Kingston
MANITOBA :					Winnipeg
ALBERTA :					Edmonton
BRITISH COLUMBIA :	Vancouver,	Victoria,	Nelson,		Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.,
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Hangers—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Heaters—Feed Water—
Mussens, Limited.
Laurie & Lamb.
Canadian Westinghouse.
Peacock Brothers.
Fraser & Chalmers, Ltd.

High Speed Steel Twist Drills—
Mussens, Limited.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co. Ltd
Peacock Brothers.
Krupp, Fried, A. G., Germany.
Mussens Limited.
Canadian Allis-Chalmers, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
Waterous Engine Works.
M. Beatty & Sons.
Can. Fairbanks-Morse Co.
Fraser & Chalmers Ltd.
Northern Canada Supply Co.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Canadian Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Limited.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Can. Cleveland Drill Co.
Northern Canada Supply Co.

Jacks—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Canadian Allis-Chalmers, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Limited.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives.
Peacock Brothers.
Ackroyd & Best.
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works.
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—electric—
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Siemens Co. of Can., Ltd.

Locomotives—Steam—
Mussens, Limited.
Canadian Westinghouse.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Ore Sacks—
Can. Bag Co.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining & Smelting Co. of Canada.
Krupp, Fried, A. G., Germany.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Limited.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Peacock Brothers.

Pipes—Rivetted—
Consolidated Mining & Smelting Co.
Peacock Brothers.
Laurie & Lamb.
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.

Pipe Fittings—
Can. H. W. Johns-Manville.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Westinghouse.
Northern Canada Supply Co.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Brothers.
Jones & Glassco.

Producer—Gas—
Krupp, Fried. A.G., Germany.
Mussens, Limited.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
Smart-Turner Machine Co.
Krupp, Fried. A.G., Germany.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.
Laurie & Lamb.
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Canadian Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Alex. Fleck.
Mussens, Limited.
Smart-Turner Machine Co.
Peacock Brothers.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Pneumotic—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Smart-Turner Machine Co.
Canadian Ingersoll-Rrand Co.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Can. Ingersoll-Rand Co.

Pumps—Steam—
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
Alex. Fleck.
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A.G., Germany.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany.

Rolls—Crushing—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Fraser & Chalmers, Ltd.
Canadian Allis-Chalmers, Ltd

Roofing—
Patterson Mfg. Co.
Dominion Bridge Co.
Mussens, Limited.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.
Head, Wrightson & Co., Ltd

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers, Ltd.

Samplers—
Canadian Laboratories.
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany.
Thos. Hays & Sons.

Screens—
Mussens, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Smart-Turner Machine Co.
Peacock Brothers.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany.

Shavels—Steam—
Mussens, Limited.
M. Beatty & Sons.

Slime Tables—
Diester Concentrator Co.
James Ore Concentrator.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Smelting Machinery—
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Can. Allis-Chalmers.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drill—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A. G., Germany.
Canadian Ingersoll-Rand Co. Ltd.
Peacock Brothers.
Swedish Steel & Imp. Co, Ltd

Steel—Tool—
Mussens, Limited.
Thos. & Wm. Smith.
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co, Ltd

Surveying Instruments—
Peacock Brothers.
W. F. Stanley.
C. L. Berger.

Switchboards—
Canadian Westinghouse.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Limited.
B. Greening Wire Co.
Can. Allis-Chalmers Ltd

Transformers—
Canadian Westinghouse.
Can. Fairbanks-Morse Co.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Transits—
C. L. Berger & Sons.
W. F. Stanley.
Peacock Brothers.

Tractors—Oil—
Canadian Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse.
Peacock Brothers.
Laurie & Lamb.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.
Krupp, Fried. A. G., Germany.
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Winding Engines—
Waterous Engine Works.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Can. Ingersoll-Rand Co., Ltd.
Fraser Chalmers, Ltd.
Siemens Co. of Can., Ltd.

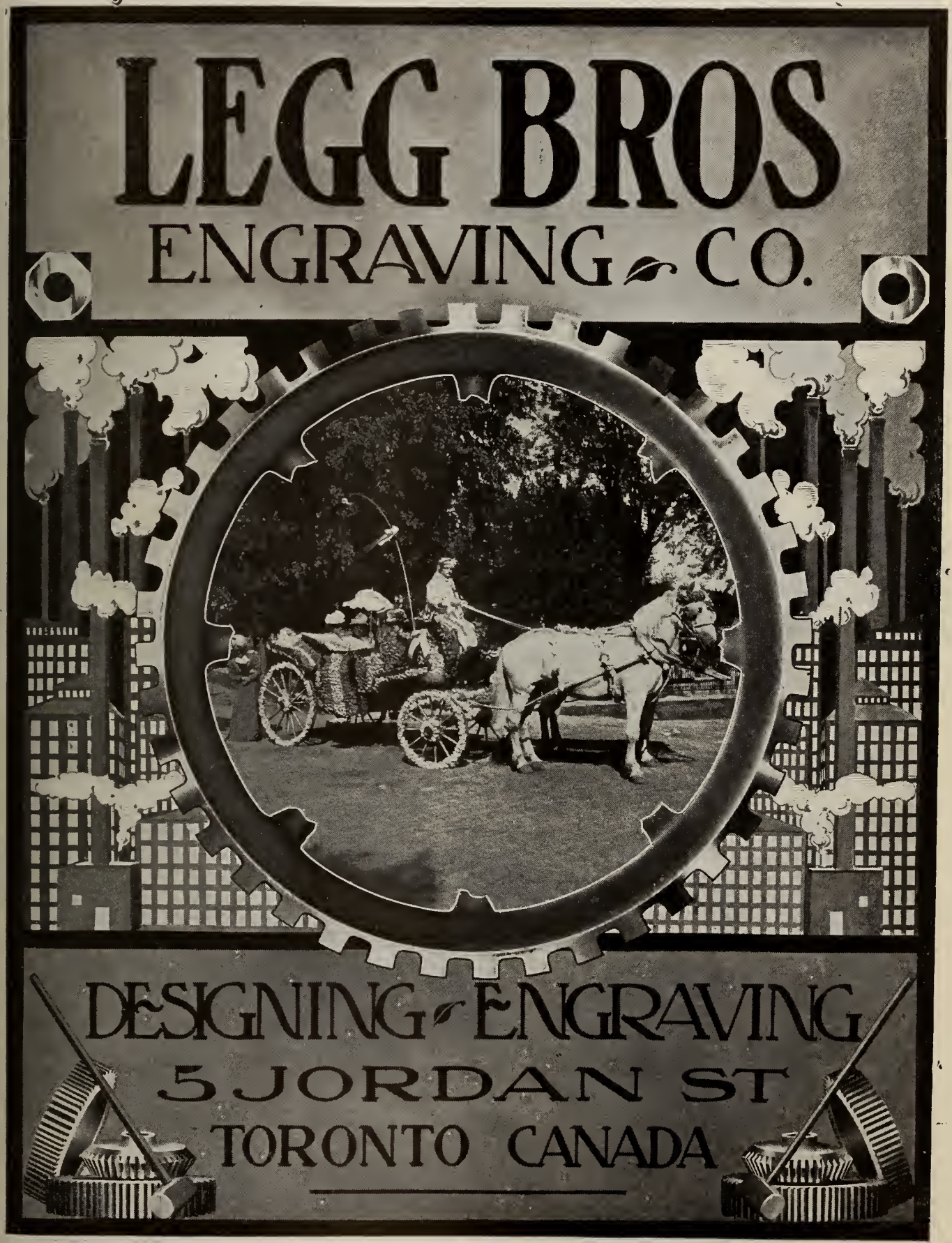
Wire Cloth—
Can. Allis-Chalmers, Ltd.
Mussens, Limited.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Standard Underground Cable Co. of Canada. Ltd.

Wire—Magnet—
Standard Underground Cable Co. of Canada. Ltd.

Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.


LEGG BROS
ENGRAVING CO.
DESIGNING ENGRAVING
5 JORDAN ST
TORONTO CANADA

Baldwin-Westinghouse Electric Locomotives for Surface Haulage

The mechanical parts are built by the Baldwin Locomotive Works, insuring a frame of the highest type of mechanical construction.

The electrical parts are built by the Canadian Westinghouse Co., insuring the highest degree of efficiency and reliability.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

— FOR REGULATIONS, MAPS, ETC., APPLY TO —

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M. A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— Published by —

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

— which also publishes —

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN — *Editor: F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industr

THOS. & WM. SMITH, LTD.,

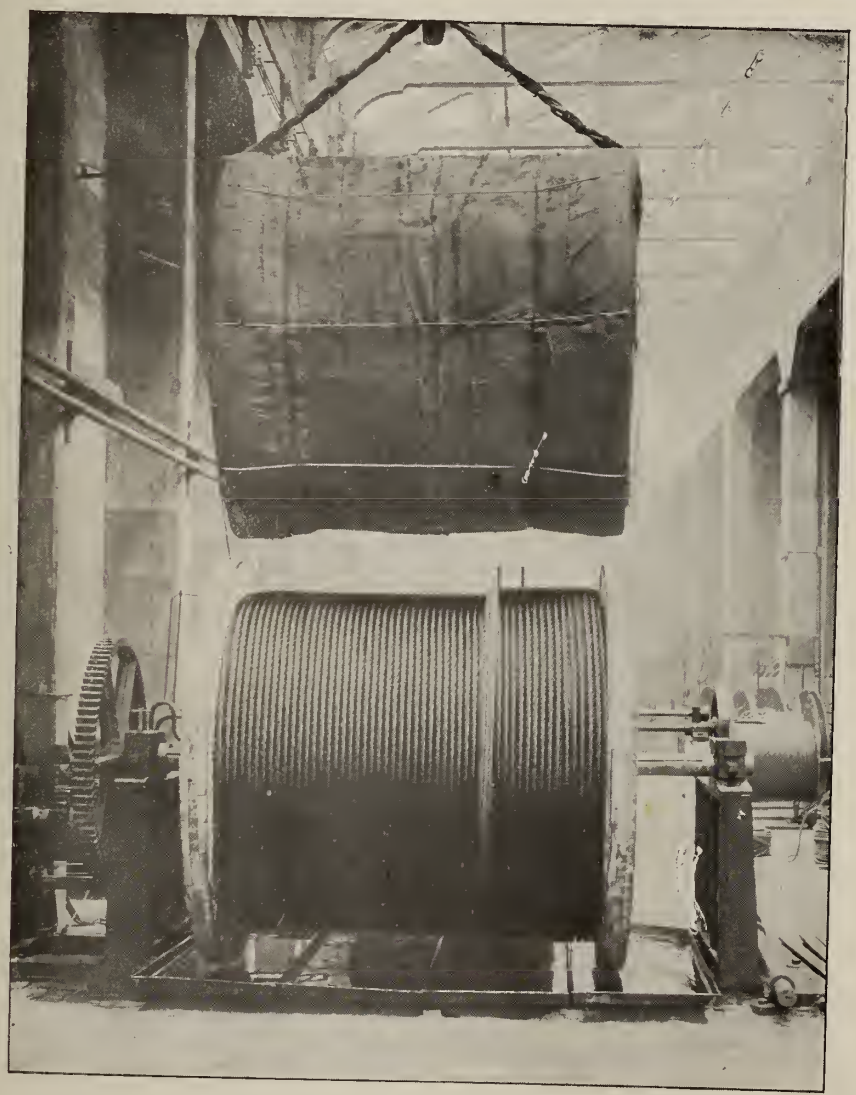
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

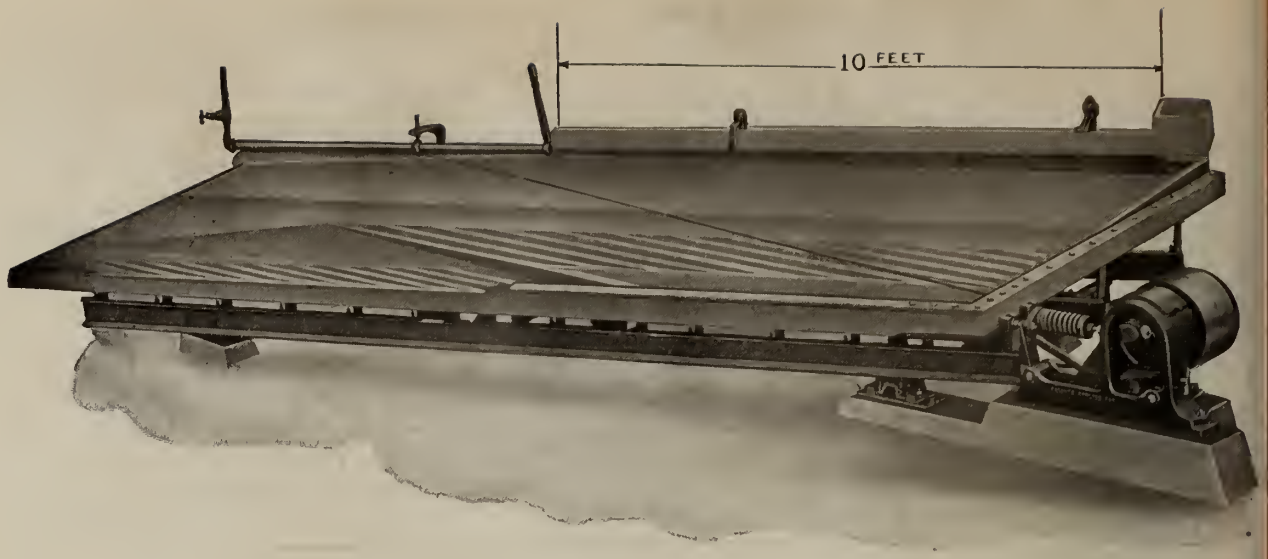
MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.



The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

1914 EXPLOSIVE CONTRACTS

Do Not Sign Before Getting Our Prices

CURTIS'S & HARVEY

CANADA (LIMITED)

400 St. James Street, MONTREAL

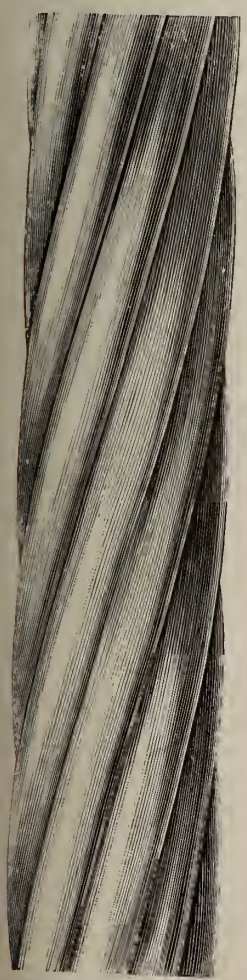
Royal Exchange Building COBALT

JANUARY 15, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

L. XXXV TORONTO No. 2

BANK HALL



Hoisting and Haulage

ROPES

Have all the good qualities of the best British manufactured cables.

Special attention is given to the Material, Construction, and every wire Minutely Tested for Breaking Strain, Elongation, Torsion and Flexion.

The Best Ropes for Hoisting, Hauling, Winding, etc., etc.

Standard Sizes and Styles Carried in Stock

Mussens Limited

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER 318 Richards St.
QUEBEC 31 St. Louis St.
ST. JOHN, N.B. 57 Symthe St.
HALIFAX 78 Granville St.

"Tested Packings for Every Purpose"

This pamphlet is an authentic text-book---a complete illustrated guide---to standard lines of tested packings.

We shall be glad to send you a copy, gratis.

Canadian Consolidated Rubber Company, Limited

MONTREAL

Please use this Coupon ☞

Canadian Consolidated Rubber Co., Ltd., Montreal.

Gentlemen :

Please send me a compl
mentary copy of "Tested Pac
ings for Every Purpose."

Name .....

Address .....

C.M.J.

We wish to particularly call the attention of Mining Engineers to the

Extra Heavy Construction of all Kennedy Mining, Milling and Crushing Machinery

Every machine, supplied by us, is of the Kennedy design and Kennedy construction. We want the privilege of letting you see Kennedy's specifications so that you can compare them with all others.

Every refinement that it is possible to put into a machine, to make it stand up to the necessary arduous requirements, is to be found in Kennedy designs.

The above applies to

Gyratory Crushers, up to 550,000 lbs. in weight.

Jaw Crushers up to 84 in. x 60 in. jaw openings.

Rolls up to 42 inches in diameter.

Kennedy Elevators with buckets 42 in. x 19 in. x 12 in.

Kennedy Revolving Screens up to 10 ft. in diameter and 60 ft. long.

Roll Hammer Crushers that will reduce hard 2 1/2 inch rock to sand in one operation at the rate of 70 tons per hour.

If you will investigate Kennedy designs you will find a good reason for buying Kennedy apparatus.

Rock & Power Machinery

Limited

P. H. MOORE - - General Manager

Late Manager Mining, Crushing and Cement Machinery
Dept. for Canadian Allis-Chalmers Limited.

HEAD OFFICE :

Royal Bank Bldg., 12 King St. East, Toronto

BRANCH OFFICES :

KING EDWARD HOTEL, TORONTO ; VANCOUVER ; CALGARY ;
WINNIPEG ; SUDBURY ; MONTREAL ; OTTAWA ;
COBALT ; HALIFAX.

Imperial Bank
of Canada

Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Paid Up	6,925,000
Reserve and Undivided Profits	8,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

Hailwood's Patent Foolproof, Flame-proof Underground Relighter for SAFELY RE-LIGHTING LAMPS IN THE MINE.

The lamp must be completely enclosed before the current can be switched on.

SOLE MAKERS

ACKROYD & BEST, LTD.

The World's Safety Lamp Experts

MORLEY, - LEEDS, ENGLAND

For full particulars apply:

ACKROYD & BEST, LTD.,

No. 2 Arrott Power Buildings, Barker Place, Pittsburgh, Pa., U.S.A.

Telephone Nos. { P. & A. Tel. Main 2217. Bell Grant 1619.

UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

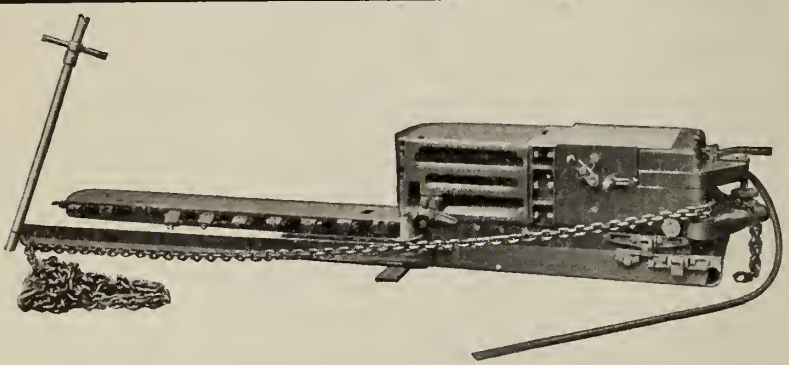
Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

For Calendar and other information apply to the Secretary,

A. T. LAING



Sullivan "AC" Iron Clad Coal Cutters

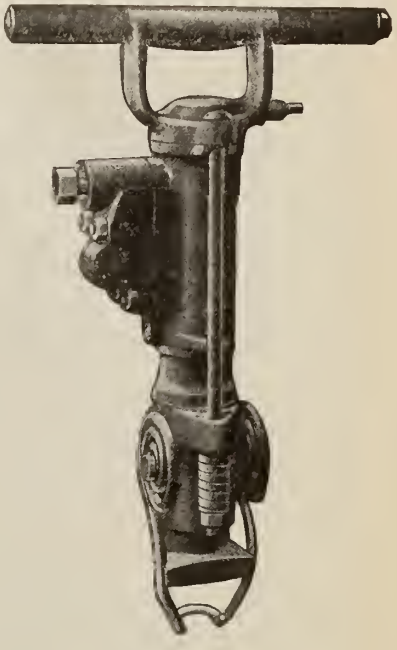
Alternating Current Motors are now available for Sullivan "Ironclad" Mining Machines. If your mine is near an electric power transmission line, you can secure the advantages of mining your coal with "Ironclads" without going to the expense of rotary converters, generator sets, etc.,—all you need is a transformer, and this the power company will usually install. **"AC Ironclads"** are low in power eonsumption and repair cost; and high in cutting capacity. The motors are totally enclosed, rendering them gas-proof. They possess all the characteristic points of superiority of the DC "Ironclads" —friction feed gearing—chain and sprocket feed—reversible cutter chain, to permit mining in either direction—armor plate housing, pan or bar for sumping, etc.

Ask for New Bulletin No. "AC," 663 H.

SULLIVAN MACHINERY COMPANY, 122 SO. MICHIGAN AVE., CHICAGO, ILLINOIS

BOSTON MONTREAL COBALT NELSON SPOKANE VANCOUVER LONDON SYDNEY, AUSTR.

How About the "Heart Action" of Your Drills?



The Jackhamer—Used extensively for sinking and down holes of moderate depth.

The Valve is the "heart" of a rock drill. Every function of the drill, as a drill, depends upon the character of its valve.

The valve determines the economy (or otherwise) of air or steam; the character of the blow; the speed of drilling. **In fact the valve action makes or mars the operation of the drill.**

Consider the "Butterfly" valve. Note first of all its simplicity, as pictured here—two sturdy wings on a centre body—all of toughest steel. Can you conceive of anything more simple—stronger—less liable to get out of order?

The ports are not opened or closed by a sliding movement, but by a movement like opening a book. Can you imagine an arrangement with less opportunity for wear?

The very slight "lift" of the valve from its seat gives an enormous port opening—**actually larger than the area of the ports themselves.** No chance here for "wire drawing" or back pressure, or slow, sluggish movement.

This "feather-weight" valve is moved by slight differences of pressure on two of its broad faces. And because it is so light **the movement of the valve is instantaneous;** while the impact on seating is so small as to be in no way injurious.

Here you have an oil-toughened, heat-treated valve of tremendous strength, working in a valve chest of simple construction with large unrestricted ports.

Because there is no wear to valve or seats—because the seating is complete and positive—there can be no leakage and waste of air or steam.

When you have fully grasped the distinctive features of this "Butterfly" valve, you'll understand why the "Jackhamer" and "Butterfly" Stopers and Plug Drills (all using the "Butterfly" valve) hit harder, drill faster, do more work per unit of power used, than any other drills you can buy.

And these are the very qualities you want in your drill—aren't they?

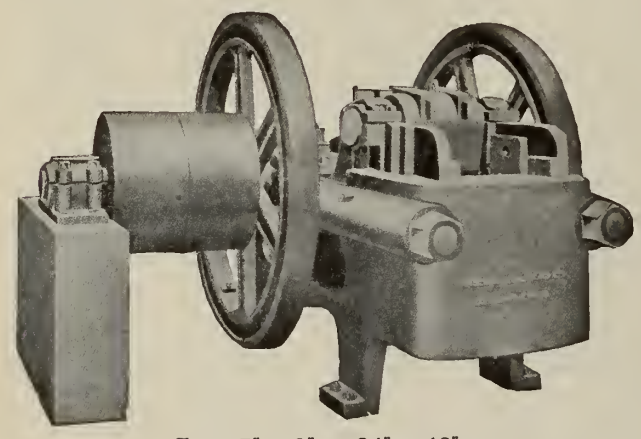
CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

BLAKE & DODGE
CRUSHERS

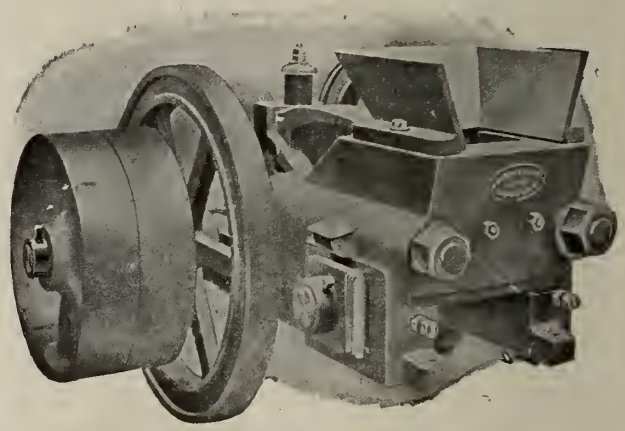


From 7" x 9" to 24" x 48"

WRITE FOR BULLETIN E-3

All Crushers are fitted with Manganese Steel Jaw Plates and Side Liners

Our Crushers are used in every Mining District in the World and are built for the most severe service



From 4" x 6" to 11" x 15"

WRITE FOR BULLETIN E-4

WE CAN MAKE IMMEDIATE SHIPMENT FROM MONTREAL STOCK

FRASER & CHALMERS

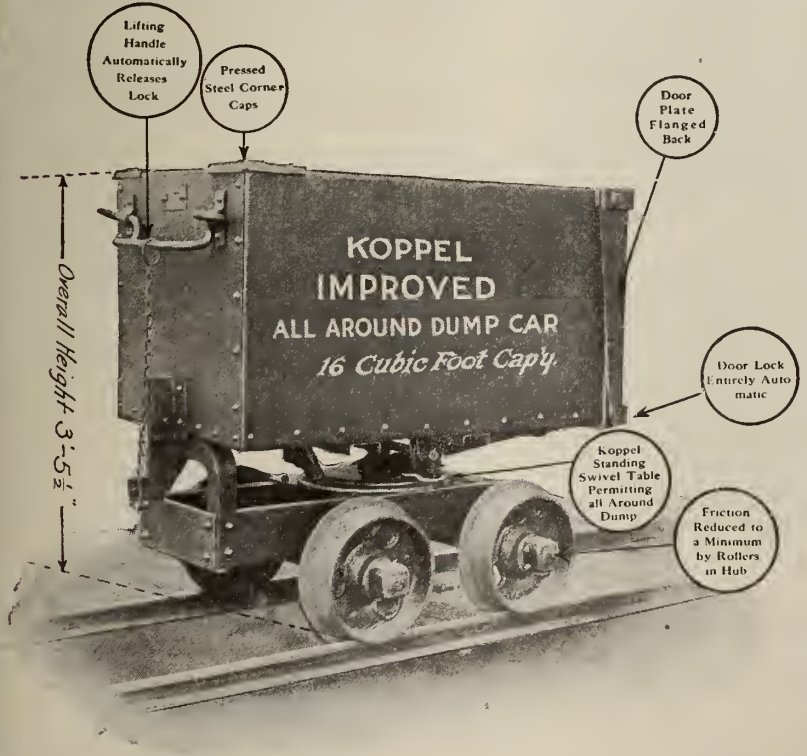
LIMITED

Canadian Branch:

4 PHILLIPS PLACE - - - MONTREAL, P.Q.

Northern Electric
Mine Phones
Save miles of walking—save valuable time—prevent accidents. Our nearest house will tell you how Northern Electric Mine Phones will
Increase Efficiency
in Your Mine. Write Us To-day
The Northern Electric
AND MANUFACTURING CO. LIMITED
Montreal Halifax Toronto
Winnipeg Regina Calgary
Edmonton Vancouver Victoria

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Capy.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

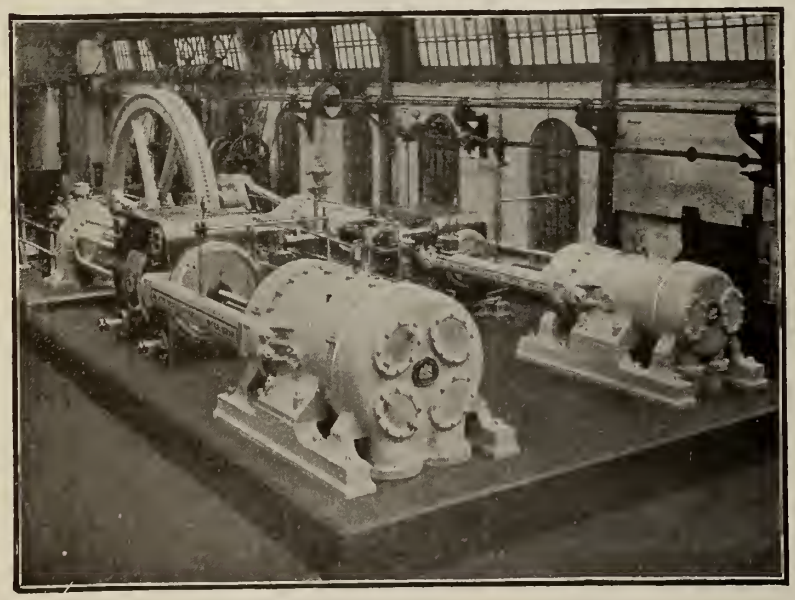
SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

THE SUPREME METAL
FOR WEARING PARTS

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

The Canadian Bank of Commerce

PAID-UP CAPITAL, $15,000,000
RESERVE - - 13,500,000

DRAFTS ON FOREIGN COUNTRIES

Arrangements have recently been completed under which the branches of this Bank are able to issue Drafts on the principal points in the following countries.

Austria-Hungary	Fr'ch Cochin-China	Norway
Belgium	Germany	Persia
Brazil	Great Britain	Phillipine Islands
Bulgaria	Greece	Roumania
Ceylon	Holland	Russia
China	Iceland	Servia
Crete	India	Siam
Denmark	Ireland	South Africa
Egypt	Italy	Straits Settlements
Faroe Islands	Japan	Sweden
Finland	Java	Switzerland
Formosa	Manchuria	Turkey
France	Mexico	West Indies and elsewhere

No Delay in Issuing. Full Particulars on Application.

American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages*, 6x9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

It's the double construction that saves you money

Don't pay out good dollars year after year for rubber hose or ordinary flexible metallic hose that quickly kinks, blows out and goes to pieces. Save money, time and trouble by using

J-M Flexible Metallic Combination Hose

This hose gives better service for a longer time than any other hose on the market. It is virtually *two hose in one.* An inner lining of high grade rubber protected by a metal armor of remarkable flexibility and strength.

J-M Combination Hose cannot be put out of service unless the armor is cut through. It will not kink, flatten or blow out; withstands a pull of 1,000 to 3,000 lbs. and a crushing strain of 300 to 800 lbs. to each four turns of its armor—according to size of hose. And it is positively pressure tight under all conditions.

Most economical hose because heavy armor permits use of light inner tube which can be renewed at small cost.

Write our nearest Branch for Booklet describing other desirable features

THE CANADIAN H. W. JOHNS-MANVILLE CO., Limited

Manufacturers of Asbestos Roofings; Pipe Coverings; Conduit; Metallic Hose; Waterproofing; Mastic Flooring; Stack Lining: Packings; Boiler Preservative, etc. 1973

TORONTO MONTREAL ASBESTOS WINNIPEG VANCOUVER

1914

We shall appreciate your enquiries and orders for Assay Supplies during the year 1914.

LYMANS, LIMITED

(ESTABLISHED 1800)

MANUFACTURING CHEMISTS

Importers and Dealers in Chemical and Assay Apparatus

MONTREAL

Genuine Satisfaction

If you have anything to do with Rock Drills, you have, probably, been disgusted with them many times and wished you were running by hand. You are striving for fewer delays, lower mining costs, increased tonnage, and increased profits, and cannot afford to leave anything untried which would aid in the attainment of the above.

Can you afford therefore to pass by

THE

"CLEVELAND" STOPE DRILL

and not give it a trial when we can guarantee that it will relieve you of this part of your troubles.

There are so many reasons "why" that we haven't space enough here to enumerate them, but will you please

Write for Bulletin No. 30.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED

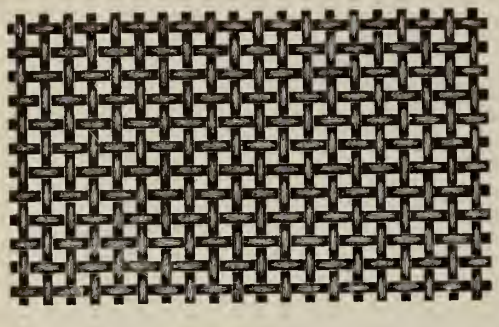
Successors to

The Canadian Cleveland Drill Co.
Limited

80 Duchess Street, TORONTO

GREENING'S

WIRE CLOTH - WIRE SCREENING



ALL GRADES OF WIRE CLOTH
DOUBLE CRIMPED

Screening Accuracy guaranteed.

Made of Steel, Copper or Brass.

Galvanized and Tinned Cloth.

PERFORATED METALS WIRE ROPE

The B. GREENING WIRE CO., Ltd.

HAMILTON, ONT. MONTREAL, QUE.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 1 4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, NOVA SCOTIA

TAKE NO CHANCES—USE MORRIS CHAIN-BLOCKS.

THE HERBERT MORRIS CRANE & HOIST COMPANY, LIMITED,

EMPRESS WORKS, Peter Street, TORONTO.

We also make Overhead Cranes and Runways.

BRANCH OFFICE, Coristine Bldg. MONTREAL.

Won't this ROBB

MINE HOISTING ENGINE

just suit you ?

Two Robb-Armstrong side-crank engines, 22 inches diameter by 42 inches stroke. Engine bearings hard babbit.

Two Drums 8 feet in diameter, 58 inches wide. Bronze sleeves.

New, complete, with steam brake, steam-operated clutch, throttle valve, etc.

FULLY GUARANTEED.

For Photos, Drawings, etc., write to

International Engineering Works Limited

AMHERST, N.S.

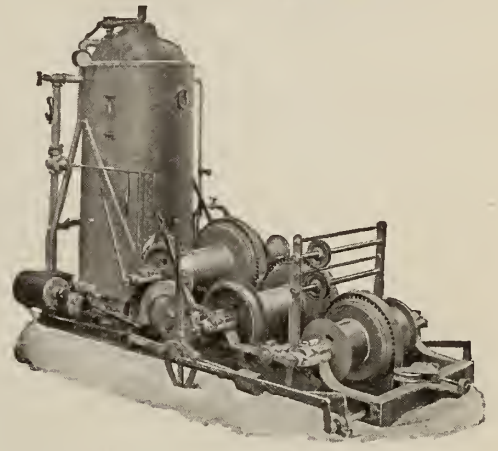
Transportation Building. Montreal

Traders Bank Building, Toronto

39-49

"BEATTY HOISTS"

STEAM OR ELECTRIC.



Standard Two-Drum Hoist with Swinger.

This represents one of many types we are prepared to furnish on short notice. Proof of their being built right and giving satisfaction, lies in the fact that a large portion of our business is made up of repeat orders.

If interested in a Hoist, Williams Fairvrette Clamshell, Steel Derrick, or Centrifugal Pump, drop us a line—we'll send full particulars.

M. BEATTY & SONS, Limited

WELLAND, ONTARIO

AGENTS:—E. Leonard & Sons, St. John, N. B., and Calgary, Alta.; H. E. Plant Montreal Que.; H. W. Petrie, Ltd., Toronto; R. Hamilton & Co., Vancouver, B.C.

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records

Year by year they increase by Leaps and Bounds.

The Reason :

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

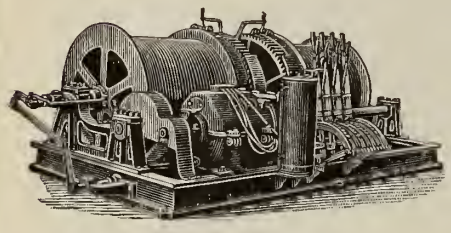
HEAD OFFICE AND FACTORY TORONTO BRANCH FACTORIES WINNIPEG AND MONTREAL

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

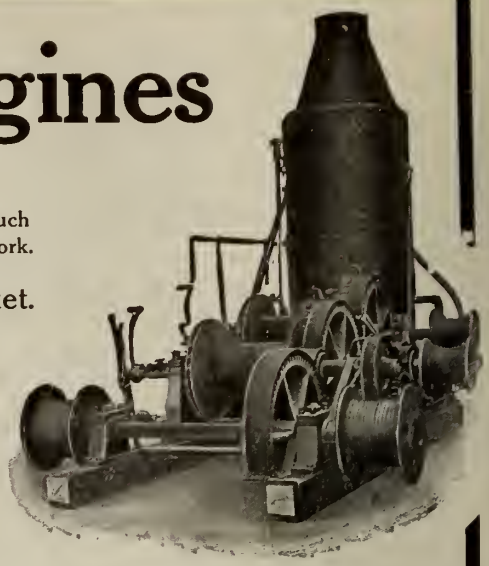


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

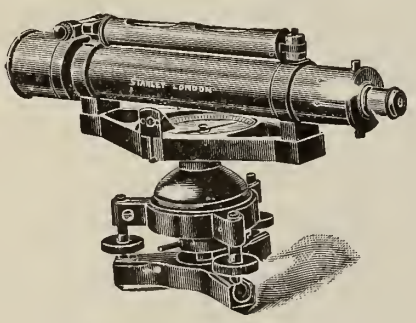
SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade STANLEY Mark

The largest manufacturers of

Surveying and Drawing Instruments

in the world.



"Stanley Quick-Setting-Up Level"

Please send for our K 35 Catalogue (post and duty free) and compare our prices with those of other first-class makers.

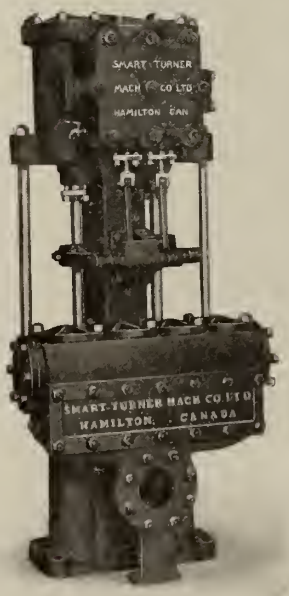
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, London, W.C.

Head Office and Showrooms:

286, High Holborn, London, England

"THE PROOF OF THE PUDDING"



Try one Pump of our make and you will be convinced of the desirability of making it your standard.

The Smart Turner Machine Co.
LIMITED
Hamilton, Canada

BAGS!

Jute Cotton Duck

FOR

ASBESTOS COAL ORE

CONCENTRATES

FLOUR GRAIN FEED

PRINTING A SPECIALTY

The Canadian Bag Company Limited

Head Office: Montreal

TORONTO WINNIPEG

Amatite ROOFING

Best for Mine Buildings

AMATITE is made so as not to need painting. It has a real mineral surface which is better than paint. It consists of mineral particles gripped in a firm, tough matrix of pitch—*the greatest waterproofing material known.*

The mineral matter and the pitch form, in fact, a sort of plastic concrete which is thoroughly weatherproof and needs no painting.

Amatite is worth much more to you than any roofing which requires painting every two years. You could well afford to pay a higher price for it. Nevertheless Amatite actually costs less than painted roofings of even less weight and will last longer.

The value of a "no paint" roofing, as contrasted with the various painted kinds, is so obvious that Amatite has attained great popularity.

Sample and illustrated booklet free on request.

THE PATERSON MFG. CO., Limited

Montreal, Toronto, Winnipeg, Vancouver, St. John, N.B., Halifax, N.S. Sydney, N.S.

School of Mining

AND

COLLEGE OF APPLIED SCIENCE

AFFILIATED TO QUEEN'S UNIVERSITY

KINGSTON - - ONTARIO

1. Four Years' Course for a Degree (B.Sc.) in
   - (a) Mining Engineering.
   - (b) Chemistry and Mineralogy.
   - (c) Mineralogy and Geology.
   - (d) Chemical Engineering.
   - (e) Civil Engineering.
   - (f) Mechanical Engineering.
   - (g) Electrical Engineering.

For Calendar of the School and further information apply to The Secretary, School of Mining, Kingston, Ontario.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and

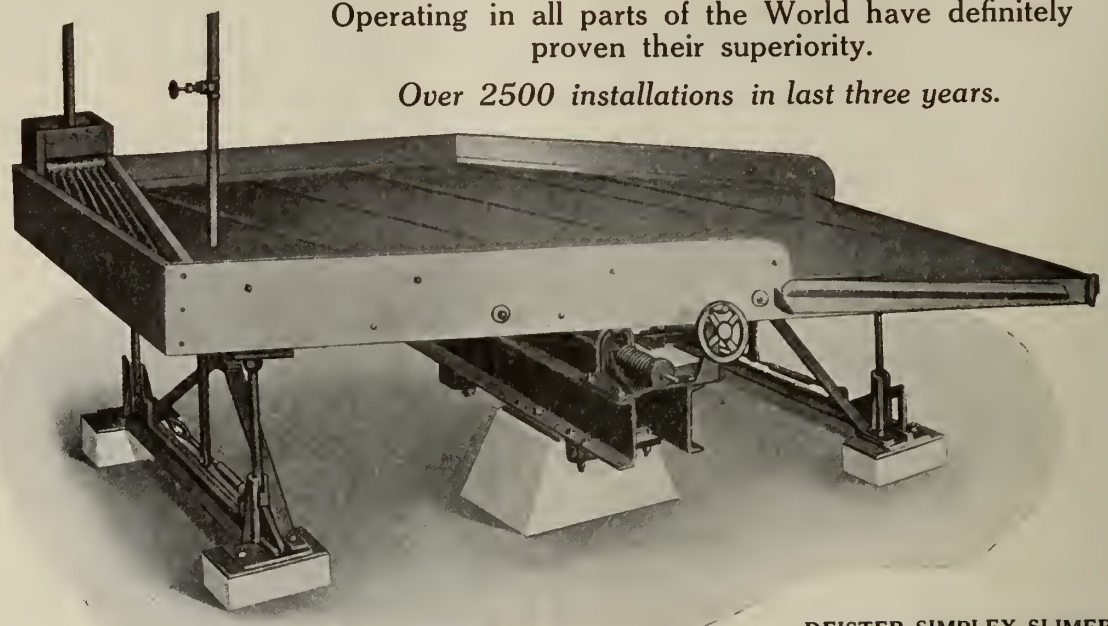
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

DEISTER SAND AND SLIME TABLES

Operating in all parts of the World have definitely proven their superiority.

Over 2500 installations in last three years.



DEISTER SIMPLEX SLIMER
Patented

WRITE FOR FULL DATA

Deister Machine Co.'s Tilting Slimer for Fine Slimes. Deister Machine Co.'s Classifier for Coarse and Fine Material

DEISTER MACHINE COMPANY, SOLE OWNERS AND MANUFACTURERS

Head Office: Shoaff Bldg., Fort Wayne, Ind., U.S.A. London Office: 562 Salisbury House, London Wall, E.C.

THE PARRAL TANK SYSTEM OF SLIME AGITATION

Parral Tank

Patented in
The United States, Canada, Mexico, etc.

No Bridge or Side Structures
No Belts or Gears
No Interior Moving Parts
No Centrifugal Pumps

Canadian Patent No. 139,537

Most Efficient—Most Economical—Simplest

Modus Operandi

The pulp is continuously transferred by compressed air through the lift pipes from top to bottom of the tank charge where its spouting force creates a Rotary flow which extends from top to bottom of the charge, keeping the solution and solid constituents in proper proportional mixture throughout the treatment period.

Cyanidation

Employed successfully for years in Cyanide Plants agitating the slime-pump of Gold and Silver ores.

Copper Ore and Flue Dust

This is the only practical system for agitating the slime of Copper Ore and Flue Dust in acid solution. For this purpose the tank, transfer-pipes and air nozzles are made entirely of wood.

Agitation, settlement, decantation dilution, re-agitation and water-washing n same tank or in any series of tanks designed by metallurgists.

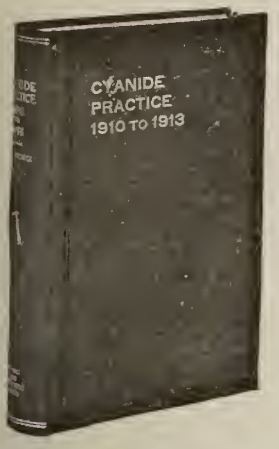
Write for full particulars to

Bernard MacDonald, 1005 Fair Oaks Ave., South Pasadena, California

The Jenckes Machine Co., Sherbrooke, Que.,

Canadian Manufacturers

CYANIDE PRACTICE
1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.

140 illustrations

Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings: Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Let us send you this new Bulletin

It is filled with valuable information for the buyer and user of cable terminals. There are tables of dimensions, weights, voltages, etc., that should be in your files. Note carefully the following:

Table of Contents

General Description of D. S. Terminals.
Regular Types of D. S. Terminals.
Inner Seal Terminals.
Wiped Joints vs. Clamped Joints.
Separation and Insulation of Conductors.
Insulating Compounds.
Terminals for Ordinary Service.
Terminals for Special Service.
Instructions for Ordering and Installing.

A card to our nearest office will bring your copy of this work. Write now.

Standard Underground Cable Co. of Canada, Limited
Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, for all purposes, also Cable Accessories.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

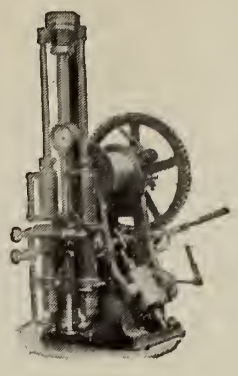
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

The Capell Patent Fans

UNDER IMPROVED PATENTS

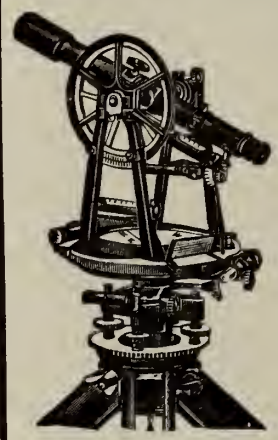
1,600 Mine Fans in use.
Highest Water Gauges and Largest Outputs.

All enquiries to

THE CAPELL FAN CO.

13 MOSBY ST., NEWCASTLE-ON-TYNE, ENGLAND

¶ *Complete Bound Copies for 1913 Canadian Mining Journal, with Index, are now ready. Price $4.00 per volume. Canadian Mining Journal, 44-46 Lombard Street, Toronto.*



C. L. BERGER & SONS

37 Williams Street

BOSTON, - MASS.

SPECIALTIES:

Standard Instruments and Appliances for Mining, Subway, Sewer and Tunnel, and all kinds of Underground work.

SEND FOR CATALOGUE

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.

Back or Current Numbers

of any American or Foreign technical or trade Journal furnished on short notice at moderate rates; also newspapers and magazines. Government and State Reports of all kinds in stock. Clippings on special subjects furnished promptly. Magazines and papers of all kinds bought.

Special subscription price list on request.

A. W. Castellanos
263 Armstrong Avenue
Jersey City, N.J., U.S.A.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

"KRUPP"

MINING-MACHINERY

Ore and Rock Breakers, Rolls, Stamps, Shoes and Dies of Special Krupp Steel, Krupp Ball Mills for Dry and Wet Crushing Ores, Chilian Mills (Edge Runners).

TUBE MILLS FOR WET GRINDING

Concentration-Amalgamation-and Cyanide-Plants.

PORTION OF A STAMP MILL FOR GOLD ORES

WET GRINDING TUBE MILLS.

ULLRICH'S Patent Electro magnetic Dry and Wet Separator for strongly and feebly Magnetic Ores.

COMPLETE INSTALLATIONS

for the

TREATMENT of ORES of every kind

Plants for the Metallurgical Treatment of Ores.

FRIED. KRUPP A.-G. GRUSONWERK

MAGDEBURG (GERMANY)

Canadian Representatives:

JAS. W. PYKE & CO., Limited, 232 St. James St. Montreal

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST **LOW MAINTENANCE CHARGES**

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD PATENT SILENT CHAINS

TRANSMISSION STORIES

"SHOWERS OF TEETH"

Iron ones too! In Messrs.....* Mixing Mill there were some heavy Mixing Machines which used to be driven through ponderous spur gears, about every other month, however, that spur gear shed its teeth, not at all like the gentle dew from Heaven, in fact attendant workmen were in constant danger; all this meant heavy expense, frequent stopping, fuses blowing out, etc.

THEN

Renold Silent Chains were installed in February, 1909. There is really no more to be said; the workmen's fears are dispelled, fuses no longer blow out, stoppage at least from that source has ceased.

THERE'S A MORAL

Does this story suggest a cure for your transmission troubles? If so, write and tell us.

JONES & GLASSCO (REG'D) Engineers

49 Place D'Youville, MONTREAL. Branch Office, Toronto.

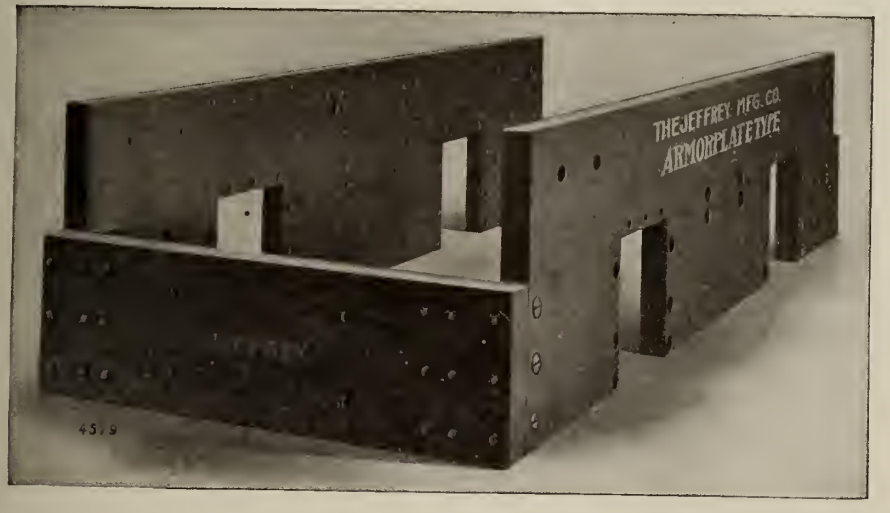
Sole Canadian Agents

*Name on application.

Note Teeth in Mesh

RENOLD PATENT SILENT CHAINS

48



The Jeffrey *ARMORPLATE* Type Frame

allows the greatest per cent. of weight to be used for motor equipment for a given weight of locomotive.

The Solid Steel Slabs are indestructible. They give absolute protection to motorman and equipment—entirely eliminate the breaking of castings due to head-on collisions, or leaving the rail and striking the rib.

This type of frame is used on Locomotives from seven tons up to and including twenty tons weight.

The Cost of upkeep for this construction is a minimum.

Send for Catalog No. 117 on our Complete Line of *STANDARD* Locomotives.

JEFFREY MANUFACTURING COMPANY

Canadian Main Office and Works:—MONTREAL

RESULTS COUNT

The Hardy Simplex Hand Hammer Drill

Will bore faster, consumes less power, and has a smaller cost of up-keep than any hammer drill on the market.

THE HARDY

saves you money.

The B-6
for all ordinary rock work

The B-7
for the very hardest of rocks

INVESTIGATE OUR CLAIMS FOR THE HARDY BEFORE YOU PLACE YOUR DRILL ORDER.

CARRIED IN STOCK

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 318 Richards St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, January 15, 1914. No. 2

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - 34B Board of Trade Building
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS JANUARY 15.

Editorial—	Page
Western Federation Methods	37
Mining in Ontario in 1913	39
The Coal Trade of Nova Scotia in 1913. By F. W. Gray..	40
The Mineral Industry in Quebec in 1913. By Theo. C. Denis	44
British Columbia in 1913. By E. Jacobs	46
Coal Mining in British Columbia in 1913. By E. Jacobs....	48
Rock House Practice of the Quincy Mining Company. By T. C. De Sollar	51
Western Federation Strike in Michigan	55
The Hudson Bay Exploring Expedition, 1912. By J. B. Tyrrell	61
Personal and General	64
Special Correspondence	66
Markets	72

WESTERN FEDERATION METHODS

Miners in Canada and the United States who belong to the Western Federation of Miners or the United Mine Workers have good reason to be disgusted with the way in which these organizations are being conducted. In Michigan the Federation and in Vancouver Island the United Mine Workers have, during the past year, added to unsavory reputations by deeds of violence and false accusations.

The strike in the Michigan copper district was called on July 23, 1913, by the Western Federation of Miners. As a very large number of the employes of the mining companies are not members of the Federation, bands of strikers were sent unexpectedly into the shops, and the workmen forced to quit. For two or three days the organized strikers controlled the situation, and terrorized the community. Their excesses were suddenly checked, however, by the prompt arrival of 2,500 soldiers, ordered to the district by Governor Ferris.

After several weeks of idleness, it became possible to open the mines again. Immediately the strikers began to abuse the men going to their work. Excited by the false teachings of their leaders, and encouraged by the liberties which the local courts allowed them, the strikers continued their unlawful practices.

In spite of the agitators, the forces at work increased. Then three workmen employed by the Copper Range Consolidated Company were murdered in their beds. The enraged citizens thereupon took a hand in affairs, and the Citizens' Alliance became a prominent factor in the struggle. At the request of the citizens, the grand jury was called upon to conduct an investigation. As a result, several of the agitators, rather than testify, hurriedly left the district, and the molestation of workmen ceased.

Then occurred the terrible calamity of Christmas eve when seventy-four people, mostly children and women, were killed in a panic at Calumet. These people had assembled for an entertainment given by the Women's Auxiliary of the Western Federation. While presents were being distributed to the little ones, someone in the hall raised a cry of fire, and the rush that followed resulted in an almost incredible loss of life.

Here was disclosed to the public the character of the president of the Federation. Without waiting for the facts to be ascertained, he hurried to send off telegrams, in which he insinuated that a member of the Citizens' Alliance had rushed into the hall and raised the cry of fire, which resulted so horribly. The fiendish cunning of the man was calculated to arouse sympathy throughout the country. It is no great credit to the

American newspapers, that several of them helped to spread Mr. Moyer's false assertions.

Not content with this performance, which might be expected to arouse the strikers to further and more terrible deeds of violence, Mr. Moyer shocked the community by ordering the families of the victims of the disaster to accept no aid from the Relief Committee, which had been hurriedly organized by the citizens. Subscriptions amounting to $25,000 were soon received by this commitee, and the members endeavored to give immediate help to those in need. In spite of the fact that many of the families are in great distress, they are afraid to accept any aid from the committee.

There is little in the strike of miners in Michigan to suggest that its object is the betterment of conditions for the workmen. The demands which have been made, in so far as they relate to improved conditions, have already been met. The one demand which has not even been considered is that the Western Federation be recognized as representing the employes. There were last July many reasons why this demand should be refused. There are now several hundred more reasons, and the recent acts of Mr. Moyer are among them.

To Canadians the strikes on Vancouver Island and in Michigan have important lessons. It is recognized in the mining industry that the men should have the right to organize and by any lawful means endeavor to obtain higher wages and improved conditions. Most of our miners are foreigners, and many of them are not in the habit of studying conditions very carefully. It is natural for them to leave the leadership in labor disputes to the officers and agitators of the labor unions. The unfortunate fact is that the officers of the two unions allied with the American Federation of Labor have proven and are proving themselves unworthy.

Under the circumstances it is not surprising to learn that the Michigan mine managers have refused to recognize the Federation, and that the men at work, who far outnumber the men on strike, have asked that Federation members be not employed in the mines.

The excuse given for calling the strike is that the men should receive a minimum wage, that the length of shift should be reduced to eight hours, and that the one-man drill should be abolished.

The objection to the one-man drill is nonsense. The eight-hour shift is required by law, and was put in force before it was required. The adoption of a minimum wage for all the mines, would, in the opinion of those who know the conditions, be unfair to several of the companies.

It is evident, therefore, that the object of the strike is recognition of the Federation. According to the union officers the number of members of the Federation in the copper district when the strike was called was 9,000, and 7,600 voted in favor of a strike. If we assume that the figures are reliable and that they mean that two-thirds of the 13,500 men employed by the copper mining companies are members of the Federation, there seems to be some reason for the Federation officers asking for recognition as representatives of the miners. If the officers have a clean record behind them and are able to show clearly that they voice the wishes of two-thirds of the employes, the mine managers should be willing to treat with them. The Western Federation is the only metal miners' union which the American Federation of Labor recognizes, and it is natural that the men prefer to join this organization on account of its national character.

To conclude that the mine managers should recognize the Federation it is necessary to assume that the Federation has a reasonably clean record and that a large majority of the employes of the Michigan copper companies are, or were on July 23, members of the Federation. Unfortunately for the strikers, neither of these assumptions is true.

R. W. BROCK TO BE DEPUTY MINISTER

A despatch from Ottawa states that Mr. R. W. Brock, Director of the Geological Survey of Canada, has been appointed Deputy Minister of Mines to succeed Mr. A. P. Low, who resigned some time ago. Mr. Brock, who has been Director of the Geological Survey since 1908, was formerly Professor of Geology at Queen's University. He studied at Toronto, Queen's and Heidelberg Universities, and joined the Geological Survey in 1897. His field work was chiefly in British Columbia, and he made a very useful study of the geology of the Rossland district.

Mr. Brock is well qualified for the position of Deputy Minister, and his friends will be pleased to learn of his appointment.

CASEY-COBALT.

A satisfactory report was presented to the shareholders of the Canadian Casey-Cobalt Mining Company in London last week. The company has had a prosperous year. Not only was the output of the property a little more than doubled, but considerable extensions were made in the plant. One feature was the building of a transmission line from New Liskeard, which enabled electrically driven equipment to be installed.

The mill was thus increased from a capacity of 30 tons a day to 80 tons a day. The total ounces shipped in 1913 were 607,621, as compared with 274,066 in the preceding year. The balance of $317,636.23 was carried forward to the credit of profit and loss, out of which subsequently a dividend was paid of $109,499.33. The total assets of the company, other than mining properties, at the end of the year, were $457,612.45. The officers and directors were re-elected as follows: W. R. P. Parker, President; J. H. Watson, Vice-President; R. E. G. Van Cutsem and G. M. Clark; C. H. C. Leggett, Secretary-Treasurer.

MINING IN ONTARIO IN 1913

Ontario made a large production of metals and non-metals in 1913. The metal mining companies had a very successful year and the shareholders of stock in the leading producers received large amounts in dividends.

As in former years the chief metals produced were gold, silver, nickel, copper and iron.

Gold.—The production of gold was very much larger than in previous years, being more than double the production of 1912. The increase is accounted for by the good results obtained in mining the gold quartz deposits in the Porcupine district. Porcupine produced about $4,000,000, and some, but a comparatively small amount of gold, was produced in the Kirkland Lake, Swastika, Larder Lake, Long Lake, and Sturgeon Lake districts.

The Hollinger and Dome mines are still by far the largest producers. The Hollinger has numerous large veins of ore, much of which is high grade. The Dome has enormous, but very irregular deposits of gold quartz, and the ore is considerably lower in grade than the Hollinger. During the year the Porcupine Crown Mining Company has completed and put into operation a simple and very successful cyanide plant. The ore bodies are relatively small but rich, and the mine is expected to be a good producer.

The McIntyre has also been shipping gold during 1913. The published reports indicate that the mine is being operated at a small profit.

Silver.—The silver output of Ontario, chiefly from Cobalt and neighboring districts, was in 1913 about the same as in 1912. In 1912 there was produced 30,719,883 oz.

In 1913, as in the previous years, leading producers were Nipissing, Coniagas, La Rose, Cobalt Townsite, Crown Reserve, Kerr Lake, McKinley-Darragh-Savage, Buffalo, and Cobalt Lake. Increases were made, however, by Seneca-Superior, the recent arrival among the large dividend payers, and the Casey Cobalt. The Timiskaming had a poor year, and has comparatively little good ore in sight.

The Kerr Lake section of the camp promises to be an interesting one during the coming year. The lake has been successfully drained and rich ore found on the bottom. The satisfactory results obtained have added considerably to the value of the Kerr Lake and Crown Reserve properties.

The old Drummond mine has been satisfactorily opened up by the new owners, Caribou Cobalt Mining Company, and good ore found under the old workings.

At Cobalt the Northern Customs concentrator was sold and a new plant has been quickly built near the La Rose. The Northern Customs Company will treat the La Rose ore at the new concentrator. The old plant is now owned by the English syndicate controlling the Townsite, Casey Cobalt, Cobalt Lake, and City of Cobalt Mining Companies, and treats the ore produced by these companies.

Nickel and Copper.—The mining companies operating in the Sudbury district found a good market for their products during 1913, and increased their output. The Mond Nickel Company completed a splendid new smelting plant, which is now in operation.

The output for the Sudbury district in 1913 was about 36,000 tons of matte. The nickel content of the matte was about 24,000 and worth, in the matte, about $5,000,000. The copper, 12,000 tons, was worth about $1,700,000. As usual, the Canadian Copper Co. was the largest producer. The International Nickel Co. paid in 1913 $3,230,000 on common, and $540,000 on preferred stock.

DIVIDENDS PAID BY ONTARIO MINING COMPANIES IN 1913.

Beaver	$60,000
Buffalo	890,000
Caribou Cobalt	25,000
Cobalt Lake	315,000
Casey Cobalt	180,000
Cobalt Townsite	363,188
Coniagas	1,640 000
Crown Reserve	849,031
Hollinger	1,170,000
Kerr Lake	600,000
La Rose	936,641
McKinley-Darragh-Savage	1,033,937
Nipissing	1,800,000
Seneca-Superior	309,940
Timiskaming & Hudson Bay	163,000
Timiskaming	150,000
Trethewey	150,000
Wettlaufer	141,758

The International Nickel Co., controlling the Canadian Copper Company, and treating chiefly Sudbury nickel-copper ores, paid during 1913 $3,230,000 on common and $540,000 on preferred shares.

COBALT TOWNSITE.

At the annual meeting of the Cobalt Townsite Mining Company, Limited (Canadian company), in London, the auditor's report showed that during the eleven months ending with September, the net earnings of the company were $629,622.80, as against $512,081.91 for the preceding twelve months.

After payment of dividends amounting to $375,000, a balance of $458,988.46 was carried forward in profit and loss account.

The issued capital of the English company is slightly under £200,000, and between 70 and 80 per cent. of this capital has now been repaid in the form of dividends.

The profit and loss account is about 45 per cent. of the issued capital. The company is now treating 200 tons of low grade ore per day at the mill recently purchased from the Northern Customs Concentrators, Limited.

The total assets of the company, other than mining property, at the close of the year amounted to $729,525.40. The total amount received from ore sales for the eleven months, plus the amount of ore in transit and at smelters, was $1,350,594.20, while the average number of men employed during the year was 245.

The engineer's report showed the ore reserves to be in excess of those at the end of 1912, notwithstanding a production for the eleven months of 1,987,921 ounces of silver.

The officers and directors were re-elected as follows: W. R. P. Parker, President; J. P. Watson, Vice-President; R. E. G. Van Cutsem, G. M. Clark and Rupert Simpson.

THE COAL TRADE OF NOVA SCOTIA IN 1913

A RESUME

By F. W. Gray

Production.—For the first time the annual coal production of Nova Scotia has exceeded 7,000,000 tons. Approximate estimates, compiled at the beginning of December, show the coal output of the Province in 1913 to be in the vicinity of 7¼ million tons, an increase of 270,000 tons over 1912.

A tabulation of the production of the various coal companies compared for three years is as follows:

Production of Nova Scotia Coal Mines.

	Tons of 2,240 lb. Calendar Year. 1911.	1912.	1913.
Dominion Coal Company—			
Glace Bay Mines	3,895,000	4,513,269	4,750,000
Springhill Mines	266,000	419,096	378,000
Nova Scotia Steel & Coal Co.	780,000	841,528	826,000
Acadia Coal Company	370,000	435,654	536,000
Inverness Coal & Railway Co.	281,000	279,318	292,000
Intercolonial Coal Co.	263,000	235,859	188,000
Maritime Coal & Railway Co.	160,000	140,000	150,000
Colonial Coal Company	30,000	36,897	67,000
Minudie Coal Co.	105,000	60,000	60,000
Cape Breton Coal, Iron & Ry. Co.	.....	.....	10,000
Miscellaneous	.....	.....	.....
	6,250,000	6,961,619	7,257,000
Cape Breton Island	5,000,000	5,671,012	5,945,000
Nova Scotia Mainland	1,250,000	1,290,607	1,312,500

Cape Breton Island produced in 1913, 5,945,000 tons, or 82 per cent. of the entire Provincial output, the percentage being identical with that of 1912.

The combined outputs of the collieries controlled by the two large Cape Breton companies, i.e., the Dominion Coal Company and the Nova Scotia Steel & Coal Co., total 5,954,000 tons, or 82 per cent. of the Provincial output, compared with 84 per cent. in 1912.

The production of the Dominion Coal Company's collieries in Cape Breton and on the Mainland was 5,128,000 tons, or 70 per cent. of the entire Nova Scotian output, against 72 per cent. in 1912. The preponderance of the two large companies is not, therefore, quite so marked as in the previous year.

In 1912, as compared with 1911, the whole of the increase came from the Dominion Coal Company's collieries, but in 1913 the Acadia Coal Company share notably in the additional production.

In the resume for 1912, the writer predicted that 1913 would not see any remarkable rise in the outputs of the Province, and that the Dominion Coal Company and the Acadia Coal Company would provide the greater portion of the expected additional tonnage. This expectation was fulfilled by the actual figures. It was further forecasted that the developments projected at the mines of the Nova Scotia Steel Company and the Inverness Coal & Railway Company would not add greatly to production until 1914. It now appears as if this expectation would be fulfilled in part only, and it is not probable that the production of the Province in 1914 will exceed 7,500,000 tons, but it should reach that figure if trade conditions are favorable. It also seems very probable that the additional tonnage will be largely contributed by the smaller companies and that the percentage of the two larger companies will decline still further. If history repeats itself, and the financial stringency of 1913 is followed by a recession in trade such as followed in 1908 after the decline in securities in 1907, it may be that the outputs of 1913 will not be exceeded.

Accidents.—There were no accidents during the year involving serious loss of life, but there was unfortunately a decided increase in the number of single fatalities, particularly those caused by falls of roof and sides. It is hoped that the occurrence is merely sporadic and is not an indication of a permanent increase. It cannot be said that the increase is due to any increase in the percentage of foreign laborers employed, as the number of foreign miners fatally injured does not exceed the number of native miners who were the victims of accident.

The Commission appointed by the Nova Scotia Government to investigate the flooding of mines from the sea in Inverness County reported to Parliament in the spring, and their findings were issued as a Sessional Paper. The burden of the report was contained in a recommendation that in future "every reasonable means should be employed to ascertain the depth, nature and condition of the overlying strata before pillars are extracted in any submarine area."

The plant of the Port Hood Colliery has been dismantled, and it is extremely improbable that any attempt will ever be made to unwater the flooded workings.

Underground Fires.—The production of coal in 1913 was much reduced by the occurrence of no less than three serious underground fires. The first fire occurred in No. 3 mine at Springhill on Christmas Eve, 1912, and necessitated the sealing off of a portion of the producing workings. Although the sealed-off area has not been as yet reopened, there is every indication that the fire is extinguished.

The Intercolonial Coal Company encountered a spontaneous outbreak of fire in the Drummond Colliery at the end of February, which, as at Springhill, rendered it necessary to seal off the affected section, and resulted in the loss of producing faces.

The Acadia Coal Company, in June, had a fire in the Albion Mine, which was fought for over two weeks, and at times presented a very serious aspect. In fighting this fire Draeger oxygen apparatus was used to great advantage, under conditions of extreme difficulty. It is the deliberate opinion of those who succeeded in extinguishing the fire—and among these were the most seasoned fire-fighters in Nova Scotia—that without the aid of the oxygen apparatus the fire could not have been subdued. In connection also with the Springhill fire Draeger apparatus have rendered effective service. In several instances during the year it has been proved that chemical fire extinguishers can be very useful in dealing with incipient mine fires.

The Acadia Coal Company, although greatly hindered by the Albion Mine fire, increased its production by 100,000 tons. The new hoisting engine at the Allan Shafts was completed and put into operation during the year, and is now hoisting four-deck cages. The Albion Mine is being entirely operated by electricity. A reduction in the colliery coal consumption from 75,812 tons in 1912 to 56,512 tons in 1913 has been effected by the economies which the electrical installation has rendered possible. To reduce colliery consumption 25 per cent. and increase the output by almost the same percentage is a noteworthy advance.

The output of the Intercolonial Coal Company was seriously interfered with by the fire previously referred to. Operations have been resumed in the second seam, and the management are hopeful of increased output in 1914.

An interesting feature in connection with the mines in the Pictou field is the apparent non-existence of the so-called McCullough Fault. The workings of the Acadia slopes and those of the Drummond mine are vertically underneath those of the Albion mine, which lies on the other side of the hypothetical fault line, and it is more than ever evident that the structure of the Pictou coalfield is not thoroughly understood.

The Springhill mines suffered a reduction in the year's output of some 40,000 tons when compared with 1912, due to the restriction caused by the fire previously mentioned. An air compressor and additional boiler capacity have been provided here during the year. Diamond-drill prospecting was carried on throughout the year, but as yet no commencement has been made on the projected new slopes.

The Maritime Coal Railway & Power Company show an increase in output over 1912 of approximately 10,000 tons. This company has been vigorously developing and the management expect to increase the daily output up to 1,000 tons by the middle of 1914. The mine is being equipped with electrical coal-cutters and electrically-operated haulages.

The production of the Minudie Coal Company during 1913 was about the same as in 1912. This company is opening up two new seams, and it is expected to double the output during 1914.

The Inverness Railway & Coal Company are now the only company mining coal in Inverness County, Cape Breton. This company's output for 1913 was the largest it has yet produced, and shows an increase on the previous year of about 13,000 tons. In 1914 the management hope to exceed 300,000 tons. A very large and powerful hoisting engine, the largest in the Province, was installed and put into operation, and is said to be giving perfect satisfaction.

Dominion Coal Co.—The estimate of the probable production of the Glace Bay mines of the Dominion Coal Company in 1913, given in the 1912 resume, was that it would be between 4,700,000 and 4,800,000 tons. The actual production will be approximately 4,750,000 tons, an increase over 1912 of almost 250,000 tons. A comparison of the outputs by collieries over the past three years is as follows:

No.	1911.	1913.	(Est.) 1913.
1.	577,405	584,834	536,000
2.	755,879	817,447	812,000
3.	171,431	131,459	119,000
4.	392,727	423,798	394,000
5.	324,511	266,966	220,000
6.	254,975	274,942	262,000
7.	194,529	202,189	224,000
8.	178,824	155,228	80,000
9.	408,869	430,670	394,000
10.	183,992	216,467	199,000
11.	. . . . .	. . . . .	45,000
12.	281,407	329,586	354,000
14.	184,544	321,946	417,000
15.	40,292	148,186	222,000
16.	17,963	130,862	260,000
21.	17,391	57,891	152,000
22.	. . . . .	20,798	60,000
Total. . . .	3,984,749	4,513,269	4,750,000

No. 7 colliery was the only one of the older mines that exceeded previous figures, and the entire increase comes from the Waterford and Birch Grove collieries, that is, from Mines Nos. 12 to 22 inclusive. All through the summer the Glace Bay mines were hampered by a shortage of workmen, and, although the increase in production is a handsome one, seeing that it followed an increase of 530,000 tons over 1911, it does not really represent the capacity of the mines, given a plentiful labor supply. Daily outputs of over 18,000 tons were numerous during the summer. The largest single day's output yet recorded was 18,956 tons, towards the end of November.

During the year the Emery seam near No. 3 colliery was reopened, and a new colliery, No. 11, has been equipped, and is now producing up to 300 tons per day.

The permanent bankheads at No. 16 and No. 22 collieries were completed, and at the present time, with the exception of the large electric hoist to be installed at No. 15 and No. 16 collieries the operating collieries in the Glace Bay district, seventeen in number, are all fully equipped and developed. Collieries which may be expected to increase in outputs are Nos. 11, 15, 16 and 22.

No. 17 colliery is unwatered, and is now ready to produce coal. It is not likely, however, that any large quantity of coal will be hoisted until the spring of 1914.

The power station which serves the Waterford collieries has received a second generating unit, and an additional Bettington boiler, making four in all of this type, is about completed. Two batteries of Babcock and Wilcox boilers are in process of installation at this station, and are expected to be under steam about March of next year. The power station is designed to hold a third generating unit, the installation of which will probably not be long delayed.

The new Baum coal-washer at Sydney was in successful operation during the year.

The new shipping pier on Sydney Harbor was completed for use at the opening of navigation, and has enabled very satisfactory despatch to be given to shipping. There were days in the shipping season when the combined output of the mines and the coal-storage

banks approached 25,000 tons in a day of nine hours, but everything went with remarkable smoothness, and there were few avoidable traffic delays. The new pier helped very largely to make this satisfactory state of affairs possible.

Whether the mines of the Dominion Coal Company can work to full capacity during 1914 will depend on trade conditions, but present indications would justify the assumption that 1914 outputs would exceed those obtained in 1913. If the mines work to full capacity the production might reach 4,900,000 tons during 1914.

Nova Scotia Steel & Coal Co.—The Nova Scotia Steel & Coal Company's output shows a slight reduction from that of 1912. The Jubilee shaft has been reopened and unwatered and is now producing 300 tons per day. A new shaft is being sunk on the same seam. Sinking is progressing favorably and is down about 160 ft. at the time of writing. The new shaft is intended for hoisting coal, and when completed the shaft now in use for this purpose will be used as an air-shaft.

This company has under construction a Baum coal-washer to have a capacity of 750 tons per ten hours. It is anticipated that the washer will be completed early in 1914.

The Colonial Coal Company have made great advances in their production, having increased their output from 36,897 tons to 67,000 tons. More than half of the year's output has been briquetted. This company have installed a briquetting plant at each of their collieries, and it is stated the briquettes are meeting with a ready sale, particularly for railway use.

The Cape Breton Coal, Iron & Railway Company are now producing a small output from the Broughton colliery. Arrangements have been made with the Dominion Coal Company to transport the Broughton coal over the Sydney & Louisburg Railway for shipment over the Louisburg Pier. It is probable that this company's output will reach 100,000 tons in 1914. A railway branch some four miles in length is under construction from the Broughton colliery to the site of a proposed pier on Mira Bay.

Royalties.—The importance of the coal industry in the welfare of Nova Scotia has never been so clearly apparent as in looking forward to the prospects for 1914. The direct yield in coal royalty payments to the Provincial revenue in 1913 will approximate $900,000, as not only is the production the largest in the history of Nova Scotia, but the tonnage royalty is now 12½ cents throughout the Province. Up to January 1, 1913, the royalty was 10 cents per ton, the Dominion Coal Company alone excepted.

Costs Increasing.—A number of coal companies have, within the past five years, disappeared from the operating lists, through physical disaster or financial difficulties, but the companies now operating are all well-established and in a position to extend their production if trade conditions will allow. Nevertheless, the conditions attending coal mining in Nova Scotia, particularly in Inverness County and on the mainland, are becoming yearly more difficult, and coal mining is further being affected by the increased cost of wages and materials that characterizes the present time. The operator's margin of profit is in many cases very slight, and in some cases there is an actual loss to the operator. The companies whose product is being sold in the St. Lawrence markets are meeting severe competition from United States coal, and at the mines they have to face increased operating expenses in every particular.

The duty on coal passing inwards to the United States, has been removed, but so far as Eastern Canada is concerned, the retention or removal of this duty is immaterial and of no effect, except in so far as it may be used as an argument in favor of allowing United States coal to reciprocally enter Canada without Customs duty. To those who meet this argument it may be pointed out that the existing market for Nova Scotian coal is held by virtue of the duty, and of that alone. If the duty is ever abrogated the Nova Scotian coal trade will irrecoverably collapse, and could not be revived even if the impossible were to happen, and Canada were to become a State in the Union. So far as Nova Scotia is concerned, the much-talked-of New England coal market does not exist, as under conditions prevailing now and in the future, West Virginia and Pennsylvania coal can always be sold there at prices below the lowest possible price at which Nova Scotia coal can be delivered and show a profit. One thing that Nova Scotia will always demand of the Federal Parliament is the retention of the coal duties, as if these were removed it would be extremely difficult to see any reason why Nova Scotia should remain in the Confederation.

Legislation.—In connection with legislation affecting the coal mining industry there is little of any importance. The Federal Government have enacted an Explosives Act which deals principally with the manufacture, transportation and storage of explosives, and should have a salutary effect on the quality of explosives, as it provides for Government tests and the preparation of a list of "permitted explosives," as is now required in Great Britain and in the United States. Now that explosives are being manufactured on a large scale in Canada, such a federal enactment was certainly due and necessary.

The Dominion Parliament are also understood to have under consideration a unified Mines Act, which has been prepared after consultation with the Provinces, and has the endorsement of the Canadian Mining Institute. This Act will presumably deal with questions of location and discovery and rights of tenure, and will affect more particularly gold and silver and metal mining. Its bearing on the coal industry will be remote, and it is not, of course, in any sense a Mines Regulation Act.

The Provincial Assembly at the last session appointed a small commission to formulate regulations covering the use of electricity in mines. The existing Coal Mines Regulation Act does not deal with this question, which is now of very considerable importance because of the general use of electricity at the coal mines, both above and below ground. The commission has not yet reported.

Examinations.—The Commissioner of Mines has issued more stringent regulations for the guidance of the Workmen's Boards of Examiners for certificates of competency for miners, shot-firers and examiners. Provision is made for notices in languages other than English, and for examination through interpreters. The fee for a certificate is increased from 50 cents to 75 cents, and the receipts are forwarded monthly to the Commissioner's Department. Formerly, the examiners retained the fees for their own remuneration, but under the new arrangement, which is far preferable, they are paid a salary.

Reading Rooms.—An interesting and commendable innovation during the year was the visit of representatives of the Reading Camp Association, two of whom were located in the Glace Bay district throughout the summer. The special mission of this association is to

supply suitable literature at mining and lumber camps, and to teach foreigners the English language, and generally to improve the status of the immigrant laborer. The tents at Glace Bay were appreciated and did excellent work. It is deplorable, but true, that throughout the mining towns of Nova Scotia there is an utter lack of anything in the way of reading rooms or recreative institutes for the use of workmen. There is not a free library nor a public bath in any mining town in the Province.

Labor matters have been tranquil during the year. The Acadia Coal Company had a dispute with their men which was amicably settled by a Board of Conciliation appointed under the Lemieux Act. The Dominion Coal Company and the Provincial Workmen's Association renewed their wage agreement until the end of 1916. The Coal Company granted an increase of six per cent. to all day-paid labor rated at under $2 per day in and about the mines, thus raising the minimum rate of the ordinary laborer from $1.60 to $1.70 per day, and that of the shiftman from $1.75 to $1.85 per day.

The Nova Scotia Mining Society moved its headquarters from Halifax to Sydney, and is now established in nicely equipped rooms, where the society's library has been installed. The first annual meeting in the new quarters will be held early in 1914.

Technical Education.—A strongly supported movement is on foot in Sydney to provide a technical school to serve the needs of the large industrial population, of which Sydney is the natural centre. The Government mining schools at the various mining centres, and the evening technical classes in Sydney have been doing excellent work, but it is felt that an industrial centre of such importance as Sydney needs more commensurate equipment for vocational training, and that proper facilities should be available to enable those who have left school to continue their studies concurrently with their daily work, the course of studies being arranged to bear on the staple industries of the district. It is not proposed to provide anything in the nature of a college, but to have a commodious building with adequate equipment and staff, where the existing technical classes of Sydney can be amplified and co-ordinated, and ambitious artisans and miners can obtain the technical knowledge to which they are entitled. Considerable assistance is expected from the Federal grant, which, it is presumed, will be available when the recommendations of the Royal Commission on Technical Education are dealt with by Parliament. A forward movement in technical education is noticeable throughout the mining districts of Nova Scotia, and there will be very general disappointment if something tangible does not result from the labors and journeyings of the Commission.

Loss of Vessels.—Concerning freighting matters, although the number of vessels lost at sea was not so great as in 1912, the year was marked by the loss of the S.S. Bridgeport, with all hands, at the end of October. A sister ship, the Glace Bay, was wrecked in the spring, when engaged in the ore trade between Sydney and Newfoundland.

These two vessels were among the finest coal freighters afloat, each having a cargo capacity of 10,000 tons of coal, and they were modern ships in every particular.

New Brunswick Coal.—Although this article purports to deal with the coal trade of Nova Scotia, a reference to the coal developments in New Brunswick will not be out of place. The only coalfield in that Province is the Grand Lake field, in many respects an interesting deposit. It has on several previous occasions been described in the columns of this journal. This coalfield is so far removed from other coal deposits that it possesses a value it would not have if the occurrence were nearer to the Nova Scotian fields. So far as is known, and the fact is practically proved, there is only one seam. It is of fair quality, varying from 16 inches to 24 inches in thickness, and lies almost flat under a thin cover which does not anywhere exceed sixty feet.

A considerable development is now taking place near Minto. Six different companies are now operating on the seam. During the past eighteen months the Minto Coal Company has been vigorously opening up their areas. At the beginning of the year this company had five shafts from which they were obtaining an output of from 150 to 200 tons per day. The output is now 300 tons, and the company is contemplating the installation of plant to give them a minimum output of 500 tons per day during 1914. Among the smaller companies may be mentioned the Kings Mines and the Rothwell Company. Each of these companies is now putting out from 50 to 80 tons daily. The Rothwell Company are putting in coal-cutting machines and hope to increase their output.

Compared with the large outputs of the Nova Scotian collieries these figures seem very small, but bearing in mind the peculiar nature of the deposit, and its distance from any other coalfield, the present developments doubtless have great local importance.

Geological Congress Excursion to Maritime Provinces.

A feature of the year was the visit of a section of the International Geological Congress to the Maritime Provinces, the most interesting portions of the trip being naturally those connected with the coal deposits. A notable outcome of this Congress is the monograph on the "Coal Resources of the World," published by Morang & Co., of Toronto, and edited by members of the Geological Survey of Canada, assisted by leading mining engineers of the Dominion. The work is monumental in its scope, and is particularly valuable for the information it gives of the coal resources of Asia. It is an illuminating fact, and one of great pertinence to Canadians, to know that out of 496,846 million tons of anthracite coal, estimated to be the world's reserve of this most valuable class of coal, not less than 407,637,000 tons, or 82 per cent., are supposed to be in Asia. More significant still is the fact that the whole of this vast anthracite reserve lies in countries populated by the Mongolian races, and 95 per cent. of it lies within the Empires of China and Japan. Among the most interesting visitors to Nova Scotia from the Geological Congress were the two gentlemen from Japan, who prepared the portion of the monograph which deals with the coalfields of China and Japan. The maps in the Atlas relating to Canada are excellent, and particular reference may be made to the maps of the Maritime coalfields and the Sydney coalfield. A noticeable omission in the Atlas is that there are no maps of the coalfields of Germany, Belgium or Russia, and, presumably, the committee must have encountered difficulties, or such important coal-producing countries would have been included in the Atlas.

The Dominion Coal Company Employes' Benefit Society has about the same membership as at the end of 1912, namely, 11,000 members.

The income for 1913 was approximately $152,000, derived as follows: Company and employes, in equal

proportions, $128,000; Government of Nova Scotia, $13,800, and interest on investments, $9,300.

There was disbursed in weekly payments for relief the sum of $86,000, or $17,000 more than in 1912; for death claims $9,600, against $7,600 in 1912, and for widows and children of deceased members $22,200, compared with $16,700 in 1912, making a total disbursement of $123,000.

At the end of the year there were dependent on the funds 122 widows and 319 children, an increase during the year of 36 widows and 26 children.

The cost of administration was $5,300, or about three per cent. of the gross income, which compares favorably with the cost of administering other societies of this nature.

The disbursements of the year, plus the accrued liabilities for dependents of members deceased during the year, take up practically the whole income of the year. This society has now been in existence almost four years, and has accumulated gross assets of about $210,000, over and above current liabilities. The records are now sufficiently extended to enable the formulation of a permanent scheme, and the services of an eminent actuary have been retained to examine into the status of the society, and to advise as to what course shall be followed to ensure the permanence of the society and of its benefactions.

THE MINERAL INDUSTRY IN THE PROVINCE OF QUEBEC, 1913

Theo. C. Denis, Quebec.

Generally speaking, the conditions during 1913 have been favorable to an increase in the value of the mineral production of the Province of Quebec, as compared with 1912. As the Quebec Mines Branch collects the statistics for the year ending December 31st, returns from producers are not sufficiently complete before February to give more than generalities.

In the first place it is fitting to mention the International Geological Congress, which held its twelfth session in Canada in 1913, as one of the events of the year in connection with the mining industry. The importance which a convention of this character may have in calling the attention of the world to our natural resources in general, and to our mineral wealth and possibilities in particular, can hardly be exaggerated. Seven of the excursions of the Congress took place in the Province of Quebec, to mining districts and to regions of geological interest, and they were attended, with the keenest interest, by mining engineers and geologists representing fourteen foreign countries.

According to the revised figures collected by the Quebec Mines Branch, the mineral production in 1912 totalled $11,187,110. It is probable that for the year now ending this figure will be increased to the vicinity of $12,000,000.

The mining of Asbestos is the mainstay of the Quebec mineral industry. In 1912 our Province shipped 111,175 tons of asbestos fibre, representing over 80 per cent. of the world's supply, and everything points to an increase of production in 1913. The condition of the asbestos industry, although more satisfactory than it has been for the last four years, still leaves something to be desired. There are three main centres of production, Thetford-Black Lake, Danville, and East Broughton. Great activity ruled in the first two districts, but in East Broughton no work whatever was carried on during 1913, where formerly four important mining and milling plants were operated. The rock of East Broughton is rich in asbestos, but the fibre is disseminated and short, the market price of the product being correspondingly low. Only the mines which could produce a certain proportion of long fibre or "crude" could operate in 1913. An idea of how close the margin is may be gathered from the fact that in 1912 the shipments of asbestos were valued at $3,059,084, on board cars at shipping points. Of this, some $500,000 came from "stock on hand" from an accumulation of the previous years, leaving a little over $2,500,000 of asbestos extracted from 1,870,608 tons of rock, which was the actual quantity of rock mined during the twelve months of 1912. This has to cover mining and milling costs, fixed charges, and all inherent expenses of management, amortization, development work and sales organization.

Copper and Sulphur Ores.—There will be a marked increase in the shipments of copper and sulphur ores from the mines in the Eastern Townships. Everything points to a record year, and the probability is that they will reach 100,000 tons, valued at $1,000,000, a proportional increase of 60 per cent. as compared with 1912. Although only two mines are operated, there is a very large territory over which the geological conditions are favorable to the occurrence of deposits similar to those worked at Eustis and at Weedon. Dr. J. A. Bancroft, of McGill University, has begun a study of these deposits and of the possibilities of the region. These investigations will be continued during the field season of 1914.

The metallic products of the Province of Quebec only enter for a small proportion of the total. In 1912 they constituted a little more than 6 per cent., and this will not be exceeded by much for 1913. And yet there are in our Province numerous possibilities of the existence of rich metalliferous deposits. Some development work was done on promising occurrences of gold near Lake Kienawasik, and on the Molybdenite deposits of Lake Kewagama, both in the Abitibi region, but no production was recorded.

Prospecting work was continued on the lead and zinc deposit near Notre-dame des Anges, in Portneuf County. This deposit is yet in the early stage of development, but gives promise of good results.

The iron industry has been at a standstill in the Province of Quebec for over two years, and the outlook for the future is not bright. The Canada Iron Corporation, which, apart from large interests in Ontario and in Nova Scotia, operated charcoal blast furnaces at Radnor and Drummondville for the production of high-grade pig iron, placed its affairs in the hands of a receiver pending a reorganization. It is said that the

abolition of the bounties on iron and steel went very hard with this company and they were unable to stand foreign competition.

Graphite.—We have again to record a disappointing year in the production of graphite. The mills of the Dominion Graphite Co. did not re-open during the year, and the shipments of graphite will be less than in 1912. The great difficulty encountered is in the concentration of the ore, so as to produce a high quality of flake graphite. The deposits are extensive; a large quantity of ten to fifteen per cent. ore could be counted upon, but as the graphite flakes are disseminated in a sillimanite gneiss, it is very difficult to eliminate the impurities.

Kaolin—Work progressed satisfactorily on the Kaolin deposit at St. Remi d'Amherst, in the County of Labelle, and shipments were made to paper manufacturers, which offer a more remunerative market than china and porcelain works.

Structural Materials.—It is expected that the production of structural materials in 1913—stone, lime, brick, cement—will be equal to the previous year's. These figures constitute over 60 per cent. of the mineral production of the Province. They have grown in the last five years from 2¾ million dollars to about 7 millions. This is indicative of the development of the country.

Legislation.—An important amendment to the Quebec Mining Law is at present before the Provincial Legislature. It provides for the reduction of the price of mining land, from $20 and $10 an acre, to $5 an acre. This measure is to meet the wishes of the prospectors, who prefer to own the land in fee simple, rather than hold it for a small yearly rental fee during the development stage, until proved to be worth the higher price previously set. This reduction in price will likely encourage prospecting in the regions north of the Transcontinental Railway.

DOME.

(Special Correspondence.)

Good progress is being made with the construction work at the Dome mill which is being enlarged by the addition of 40 stamps and the other necessary machinery. The enlarged mill will have a somewhat different treatment process from that now in use, by which all the product is slimed, the slimes being treated in pachuca tanks. A feature of the enlarged mill will be the use of the sand leaching treatment. The slimes will be treated with the present equipment. Eventually the slimes may be cyanided direct in the filter presses. Both the original plant and the addition have been designed and erected by the Merrill Metallurgical Company who have also had technical supervision of the milling operations.

During the past few months, the plant has shown a steadily increasing production and the tonnage treated has increased from 9,863 tons in April to 13,820 tons in November. It is understood that the tonnage for December will be approximately the same as for the preceding month, which constituted a record monthly production for the Porcupine district. This increase in tonnage treated is not due to changes of supervision or treatment in the mill; but is the result of overcoming the initial difficulties that are incident to the commencement of operations in any new property and to the gradual building up of an organization capable of the most efficient results.

CANADIAN ROUTE TO CHISANA (SHUSHANNA), ALASKA.

Mr. E. J. White, editor and publisher of the "Weekly Star," published at Whitehorse, southern Yukon, was in Victoria, B.C., a few weeks ago. The "Daily Colonist" printed the following report of what Mr. White said to its representative:

"The season just closed was a good one from a financial point for Yukon, especially the southern portion of the territory. At Whitehorse, which is situated at the northern terminus of the White Pass & Yukon Railway, and at the head of navigation on the Yukon river. The Atlas Mining Co., backed by English and Spokane capital, is developing a great mine in what is known as the Pueblo property which, for many years, has been owned and operated by Byron N. White, of Slocan Star fame, and which is now being operated under a lease from him. The company is shipping an average of 200 tons of copper ore daily for the past 20 months, and expects to largely increase the output by next spring. The ore is shipped to the Tacoma smelter.

"The rush to the Shushanna country the coming spring bids fair to almost rival that to the Klondike during the early days of Yukon," continued Mr. White. "At present fully 800 men are camped at various points along the trail between Whitehorse and Shushanna waiting until the trail is in fit condition for freighting. Both horses and dogs will be used, a 50-pound canine being worth at the rate of $1 a pound when I left the North three weeks ago."

Asked as to the most feasible route for reaching the scene of the most recent strike, Mr. White said:

"The Yukon route by way of Whitehorse is the only safe and sane one by which the Shushanna can be reached in the winter season. Cordova, Alaska, is boosting its route, leading over the deadly Scolai pass, but experienced 'sourdoughs' are afraid of it. True, it is shorter than that by way of Whitehorse, but as it leads over glaciers nearly all the way, those who have travelled by both are unanimous in recommending the Canadian route."

To the foregoing may be added the following, taken from the "Weekly Star," report of an exhibition of pictures of the trails leading to the Chisana (Shushanna) country taken last summer by Dr. Leonard Sudgen, who endeavored to show the difficulties and hardships to be encountered by those who travel to the new goldfield:

"The pictures of the different outfits on their way to the gold-diggings were certainly good, and considering the circumstances under which they were taken, the doctor deserves great credit for his work. The scenes of the several glaciers along the way were awe-inspiring, and one got some idea of what it would be to cross a glacier in the winter time. Pictures of the trail leading by way of McCarthy also of the Scolai pass revealed the fact that these routes were well nigh impassable.

"The conditions on the Whitehorse-Kluane trail were different altogether. We saw an outfit of an 8-horse team starting out for the new camp, also several dog-teams, and the comparative ease and comfort with which they were travelling gave an onlooker the impression that this surely is by far the sanest and only reliable way to get to the country where the gold has been found."

BRITISH COLUMBIA IN 1913

By E. Jacobs.

An approximate estimate of the value of the mineral production of British Columbia for the year 1913 makes it appear probable that the total will be about $29,970,000, which amount is $2,470,000 less than that for 1912. The decrease is attributed chiefly to a smaller production of copper and coal, which, together with lower average prices for some of the metals, accounts for a decrease of nearly $3,000,000 offset to only a comparatively small extent by increases in output of gold, silver, lead and coke.

Preliminary figures indicate a smaller yield of placer gold than in 1912, which, however, is more than compensated for by an estimated increase in lode gold of about 9,500 oz. Production of silver seems to have been larger by about 220,000 oz., and of zinc by 760,000 lb. Lead is estimated at 2,130,000 lb. more than in 1912, but copper is placed at nearly 4,000,000 lb. less. The decrease in net production of coal, that is after making allowance for the quantity made into coke, was about 493,000 long tons, which loss in value is reduced to some extent by an increase of 20,600 tons in the quantity of coke made.

The next following figures show approximate quantities of minerals produced in 1913 with, in parentheses, for purposes of comparison, the actual amounts for 1912: Placer gold, 26,500 oz. (27,775 oz.); lode gold, 267,000 oz. (257,496 oz.); silver, 3,350,000 oz. (3,132,108 oz); lead, 47,000,000 lb. (44,871,454 lb.); copper, 47,500,000 lb. (51,456,537 lb.); zinc, 6,120,000 lb. (5,358,230 lb.); coal, 2,136,000 long tons (2,628,804 tons); coke, 285,000 long tons (264,333 tons). Miscellaneous materials—clay products, building stone, cement, etc.—have been estimated at a total value of $3,400,000, as compared with $3,435,722 in 1912.

The official figures, to be compiled from returns to the Provincial Department of Mines, will not be available for several months, since they are not yet received by the Department. The foregoing, however, will in all likelihood be found to be approximately correct, though probably a little under what the official statement will eventually show the year's production to have been.

Gold.—Pending receipts of figures of actual production, the yield of placer gold is placed at a total value of $530,000, as against $555,500 for 1912. In Cariboo district, for which the estimate is $196,000, there apears to have been a sufficient decrease in Quesnel division to largely account for a lower total recovery in 1913 from the mines of the district of about $42,000. Atlin division of Cassiar district is estimated to have made an increase as compared with 1912, of about $20,000—$310,000 in 1913, as against $290,000 in 1912. The remaining $24,000 for all other parts of the Province compares with $27,500 for 1912.

An increase of about 10,000 oz. of lode gold is credited to Rossland, Boundary and Similkameen mines while a decrease of 2,000 oz. is estimated against mines in Nelson division. There does not appear to have been much change in the production of other parts of the Province. The chief gold-producing mines were: In Rossland camp, the Centre Star-War Eagle group, Le Roi, and Josie (Le Roi No. 2); in Boundary district, the copper-gold mines of the Granby British Columbia Copper, and New Dominion Copper companies; and in Similkameen district, the Nickel Plate group of the Hedley Gold Mining Co. These several districts produced about 260,000 oz., leaving only 7,000 oz. for other parts of the Province.

It is noteworthy that only one previous year has been credited with so comparatively large a production of lode gold, namely, 1910 with a total of 267,701 oz. toward which Nelson division contributed much more than it has done in any year since. The outlook for an increasing production of lode gold is decidedly favorable.

Silver.—Of the total of 3,350,000 oz. of silver, about 420,000 oz. came from East Kootenay, nearly all from the Sullivan Group mines; Ainsworth division of West Kootenay yielded about 300,000 oz., Slocan 1,830,000 oz., Nelson 145,000 oz., Rossland 120,000 oz., and Lardeau 30,000 oz.; from mines in Boundary district approximately 385,000 oz. was obtained, and from the Coast district 120,000 oz. This, however, is only a rough approximation of the proportions of the total production of the Province contributed by the various silver-producing districts mentioned.

The production of silver, if the estimated output prove about as stated above, will have been the highest for any year since 1905, when 3,439,417 oz. was produced. It is reasonable to look for an appreciably higher yield of this metal in 1914, especially from Slocan mines, and in smaller degree from Ainsworth and Omineca division mines.

Lead.—Preliminary returns show a production of ore containing about 50,000,000 lb. of lead. Of this, 20,000,000 lb. was in ores from East Kootenay (practically all from the Sullivan mines); from Ainsworth division mines ore in which there was some 9,000,000 lb. was sent to the smeltery, most of this having been produced from the Bluebell mine; from Slocan mines reports have been received of about 18,000,000 lb. in ores shipped, chiefly from the Standard mine; while mines in Nelson division shipped ores containing the greater part of the remaining 3,000,000 lb. The actual production of metallic lead, however, seems to have been about 47,000,000 lb.

Mining conditions indicate increase in quantity of lead ore available for extraction, this being the result of developments in mines in East Kootenay and Slocan especially. As in the case of silver, Ainsworth and Omineca mines may be expected to make an increased production of lead, and Nelson division should also add a larger proportion to the total than it did in 1913.

Copper.—A total output of 47,000,000 lb. is estimated. Of this quantity about 30,000,000 lb. was from the mines of Granby, British Columbia Copper, and New Dominion Copper companies, all operating in Boundary district; from Rossland and Nelson mines there was about 2,000,000 lb.; Coast mines, chiefly the Britannia, made an output of something like 15,000,000 lb.

The lower total of copper as compared with 1912 is attributable chiefly to the fact that economies in connection with mining and smelting costs have admitted of the utilization of ore having so small a copper content that, under other circumstances, it could not be handled at all except at a loss. The results achieved by the four companies mining and smelting copper-bearing ores in the Province, are most creditable, especially

where ores containing little gold and silver have had to be treated. The ensuing year will see an important addition to the copper-producers of the Province, for the Granby Consolidated Co.'s Hidden Creek mines, in the Coast district, are expected to commence production very shortly.

Zinc.—Of a total of 6,120,000 lb. of zinc contained in concentrates shipped to Bartlesville, Oklahoma, more than four-fifths was from the Standard Silver-Lead Mining Co., at Silverton, Slocan, and the remaining one-fifth was largely from the Van-Roi and Rambler-Cariboo mines, also in Slocan district.

Experiments in electric smelting of lead-zinc ores are being prepared for at Nelson by the Mines Branch of the Canada Department of Mines. Meanwhile other provision will be made for utilizing much zinc ore not now being utilized, owing to lack of suitable facilities for making it marketable. Fine grinding with Hardinge conical mills is expected to assist in making a 150-ton unit of Minerals Separation flotation process plant a producer at the mill of the Silverton Mines, Ltd., and the concentrating mill of the Slocan Star which in past years did excellent work in zinc-saving is also to be operated, after a long period of inactivity. The Consolidated Co.'s work in the direction of saving zinc in ores sent to Trail for reduction may, as well, ere long, result in the commercial recovery of zinc.

Coal and Coke.—The gross output of coal in 1913 is estimated at 2,576,000 long tons; of that quantity there was made into coke some 440,000 tons. In round figures, the net output was approximately 2,136,000 tons. These figures compare with a production in 1912 of 3,025,000 tons gross and 2,628,000 tons net. In the Crowsnest district, Southeast Kootenay, there was an increase of nearly 90,000 tons, and in the Nicola-Princeton district 56,000 tons, together 146,000 tons. On the other hand, labor troubles at Vancouver Island collieries, extended over eight months of the year, caused the output of Island mines as a whole to be considerably less—595,000 tons—than that of 1912, in which similar difficulties were not experienced.

Of the net production of 2,136,000 tons of coal, the proportion of mines in the Crowsnest district was about 910,000 tons; of those in Nicola valley and Similkameen, approximately 263,000 tons; and on Vancouver island, 963,000 tons.

Returns of coke production show a total of about 285,000 long tons, which is the largest quantity produced in any year since coke-making was commenced in the Province. All this coke was made in Crowsnest district—about four-fifths at the ovens of the Crowsnest Pass Coal Co., and one-fifth at those of the Hosmer Mines, Ltd. The former company made 225,400 tons in 1913, as compared with 219,000 tons, in 1912, and the latter 59,600 tons, as against 45,300 tons in 1912.

District Notes.

The year was marked by progress in the several mining districts, as follows:

While recovery of placer gold was not large in Cariboo district, preparations were made for extending hydraulic mining operations in all three of its divisions —Cariboo, Quesnel, and Omineca. In Atlin division, Cassiar district, beside recovering more placer gold, lode gold had attention, with promise of an increasing yield in the future.

In East Kootenay, developments at the Sullivan Group mines were decidedly satisfactory, while there is promise of more ore being found in the St. Eugene. Some of the coal mines in this district had, as regards production, the best year in their history.

West Kootenay mining divisions showed progress generally, notably in Ainsworth, Slocan, and Trail Creek (Rossland). Deep-level development in several Slocan mines greatly improved the position for ore-production. In the gold-copper mines of Rossland camp there were opened newly-found oreshoots that ensure profitable working of the mines there for years, while improvements at the Consolidated Mining and Smelting Co.'s copper and lead smelting works at Trail, a few miles from Rossland, provide for more effective and economical metallurgical operations and results there.

In Boundary district, shipment of ore from Franklin camp was commenced on a small scale; the Jewel mine and stamp mill were working the whole of the latter half of the year after long inactivity; and the big copper mines were worked to full producing capacity. The Hedley Co. commenced to prepare for development of more power to admit of an extension of mining and milling operations. In Kamloops division, the Iron Mask mine was productive, and electrically operated power plant was put in. In Lillooet division there was some gold-ore milling done, and near Hope, in Yale division, lode mining was commenced.

The chief features of the year's metalliferous mining in the Coast district were the enlarged operations of the Britannia Mining and Smelting Co., which put in a Minerals Separation flotation process plant of much larger capacity, in connection with concentration of its copper ores; and of the Granby Consolidated Co. at its Hidden Creek mine, Observatory inlet, where much more development work was done underground, and the work of installing power plant for mine and erection and equipment of a 2,000-ton copper smeltery were well advanced toward completion. Shipment of silver-lead ore from mines in Hazelton district, Skeena river country, was commenced, and some important deep-level development was done in Portland Canal mining division.

Dividends.

A larger total amount was paid in dividends in 1913 by metalliferous mining companies operating in the Province than for many previous years. These included the British Columbia Copper Co., $88,756 ($177,513); Consolidated Mining and Smelting Co., $232,208 ($232,208); Granby Consolidated Co., $899,911 (nil); Hedley Gold Mining Co., $360,000 ($360,000); Le Roi No. 2, Ltd., $43,200 ($29,400); Standard Silver-Lead Mining Co., $650,000 ($425,000); total, $2,326,283 ($1,224,121). The figures in parentheses show the 1912 dividends. The total amount of net profits earned was much larger than the total of dividend distributions. With prices of metals fairly well maintained and no unlooked for interruption to ore-production, the year 1914 should be an even more profitable one to the companies mentioned above, and to others that were not on the dividend-paying list in 1913.

Mr. L. C. Randolph, advertising Manager of the Canadian Fairbanks-Morse Company, has resigned to open up and take charge of a New York office for the Industrial and Educational Press, Limited, of Montreal and Toronto, publishers of the Journal of Commerce, Pulp and Paper Magazine, Canadian Textile Journal, Canadian Mining Journal, Canadian Miller and Cerealist and the Canadian Fisherman.

COAL MINING IN BRITISH COLUMBIA IN 1913

By E. Jacobs.

Coal mining in British Columbia in 1913 was adversely affected by labor troubles at Vancouver Island coal mines, which caused a decrease in production of nearly 40 per cent. as compared with 1912, the quantities of coal produced from those mines in the two years having been 1,558,208 long tons in 1912 and 962,620 tons in 1913. In other producing districts in the province there was an increase in output which in part offset that decrease, so that the percentage of loss in production in the whole province, as compared with 1912, was a little less than 15 per cent., the total for the two years, respectively, having been 3,025,709 tons for 1912 and 2,576,172 tons for 1913. The quantity of coal made into coke was larger in 1913 than in 1912—440,091 tons, as compared with 396,905 tons—which further reduced the net total of coal sold or otherwise disposed of as such. The net output of coal in 1913 was 2,136,081 long tons, as compared with 2,628,804 tons in 1912.

The districts in which coal was mined, and the proportions of production of the various mining companies, are shown in the following table:

Production of Coal in 1913.

Coal was produced in three districts, namely, on Vancouver island, in Nicola valley and Similkameen, and in Southeast Kootenay. Approximate figures of production follow:

	Tons of 2240 lbs.
Vancouver Island—	
Canadian Collieries (Dunsmuir), Ltd...	562,705
Western Fuel Co.	218,691
Vancouver-Nanaimo Coal Mining Co....	100,449
Pacific Coast Coal Mines, Ltd.	80,775
Total.	962,620
Nicola and Similkameen—	
Inland Coal and Coke Co.	116,000
Nicola Valley Coal and Coke Co.	110,000
Princeton Coal and Land Co.	28,780
Several small producers.	7,988
Total.	262,768
Southeast Kootenay—	
Crowsnest Pass Coal Co.	1,040,374
Hosmer Mines, Ltd.	237,500
Corbin Coal and Coke	72,910
Total.	1,350,784
Summary—	
Vancouver Island mines	962,620
Nicola and Similkameen mines	262,768
Southeast Kootenay mines	1,350,784
Total production, gross	2,576,172
Less made into coke	440,091
Total production, net	2,136,081

While the foregoing figures for 1913 are subject to some change, owing to production for the month of December having had to be estimated, it is unlikely there will be any considerable difference between the estimated output of coal as shown above and the actual production the revised figures will show later.

A Record Output of Coke.

The quantity of coke made in 1913 is estimated at 285,110 long tons, all at collieries in Southeast Kootenay—225,468 tons at the ovens of the Crowsnest Pass Coal Co. at Fernie and Michel, and 59,642 tons at those of the Hosmer Mines, Ltd. The total quantity of coke made in 1912 was 264,333 tons—218,954 by the Crowsnest Pass Coal Co. and 45,379 tons by the Hosmer Mines, Ltd,, so that both companies show an increase in 1913. It is noteworthy that the production of coke in 1913 was the largest yearly output on record in the province, the highest previous total having been that for 1905—of 271,785 tons. No information is yet available as to where all the coke made in 1913 was marketed, but it is known that both the Granby Consolidated Co., and the Consolidated Mining and Smelting Co. of Canada, the former having copper smelting works at Grand Forks, Boundary district, and the latter at Trail, West Kootenay, both in British Columbia, obtain their coke supplies from Crowsnest Pass collieries in the province, although the British Columbia Copper Co.'s smelting works at Greenwood is supplied from the International Coal and Coke Co.'s ovens, at the Alberta end of the Pass.

At Vancouver Island Collieries.

The strike forced upon the coal miners of Vancouver island at the beginning of May by the United Mine Workers of America and which has been in effect ever since, necessarily interfered with important mine development, equipment and construction work previously undertaken by three of the Island coal mining companies. However, much progress was made by the Canadian Collieries (Dunsmuir), Ltd., with its improvements at mines of the Comox colliery, and the Pacific Coast Coal Mines, Ltd., also advanced its development and construction work at its Morden colliery, though not to the extent it would have done under favorable labor conditions. The Western Fuel Co. has been much hampered by the strike, so that little progress was made since last April toward bringing into production its new mine situated some four miles from Nanaimo.

Canadian Collieries.—This company operates two collieries—Comox and Extension. Its chief activities in 1913 were at the mines and other works of the former.

The hydro-electric power station and plant at Puntledge river was completed, and has since been in successful operation. General Electric Co. equipment has been put in, transmission lines constructed to several mines and to the company's shops, coal-washery, shipping wharves, etc., at Union bay, substations erected, and connections made at various places for lighting purposes.

A length of new railway, which cuts off a heavy grade on the old track, has been constructed, this admitting of hauling heavier trainloads than was previously practicable.

At No. 4 mine, development work has been with the object of increasing output of coal. A new Sirocco fan was put in and ventilation of the mine improved. The old haulage steam-operated machinery is being gradually replaced by electrical installations. Similarly at No. 5 mine, steam-driven machinery has had to give way to electrically-operated plant. No. 6 mine is still being worked with the old steam plant, but at No. 7 compressor, hoist, haulage plant, fan, etc., are all electrically operated; more miners' houses and other buildings have been erected, new railway sidings put in the yard, and many other improvements made.

No. 8 is a new mine situated one mile and a half east of No. 7 and four and a half miles from the town of Cumberland. Two shafts—main shaft 11x22 ft. and air shaft 11x16 ft.—have been sunk to a depth of about 1,000 ft. and the mine is being opened rapidly, with coal now being produced. A steel tipple, equipped with Marcus screen, has been erected, and 75 miners' houses have been built. The company's sawmill was destroyed by fire, but this is to be replaced shortly.

At the company's Extension colliery mines production of coal is now only about one-seventh that of Comox—300 tons a day as compared with about 2100 tons, but when the new electric locomotives are in use, in place of those destroyed by the strikers when they set fire to the surface buildings, a much larger output will be made.

Western Fuel Co.—Before the strike 1,300 to 1,400 men were employed at this company's No. 1 Shaft, Protection Island, and No. 4 Northfield (Brechin) mines, but at the close of the year only about one-fourth that number were at work.

At the company's Reserve Shaft mine the two shafts, each 10 ft. by 25 ft. 9 in. inside timbers, reached the coal at a little more than 1,000 ft depth. Hoisting engines installed are by Andrew Barclay & Sons, Kilmarnock, Scotland; the main engine is 30 by 60 in., Corliss valve, with 12-ft. drums. Both are equipped with special devices to prevent overwinding. Transportation is provided by a standard-gauge railway to the company's shipping docks and loading bunkers near No. 1 Shaft mine, Nanaimo.

Pacific Coast Coal Mines.—Not much change was made at this company's South Wellington mine. A larger compressor was put in, and more houses for miners were built. Output of coal is being gradually increased and it is expected it will shortly be back to normal, as before the strike.

At Morden, two miles east of South Wellington, the company has sunk two shafts—main shaft 9x16 ft. and air shaft 9x12 ft. in the clear—and reached the coal at about 600 ft. depth early in the year, but development of the mine was prevented by the strike of men, so the shaft was flooded. The high-pressure side of a Canadian Ingersoll-Rand compressor has been put in, also high-pressure steam boilers, together, 450 h.p., and a pair of 24x48 high-duty winding engines. The construction of a reinforced steel tipple and coal-washing plant has been commenced, and the installation of a fan, two direct-connected electric units each 150 kw., and the necessary work about the yard are in hand. It is expected this equipment will be completed by March 1. Present development of the Morden mine shows a seam of coal 8 ft. in thickness.

The standard-gauge railway track from South Wellington to the shipping docks at Boat harbor, seven miles, has been relaid with heavier steel.

At the company's Suquash mine, in the northern part of the Island, mine development, construction work, and equipment have been in progress during the time the miners have been on strike. A new shaft, 11x22 ft. in the clear, is being sunk and a pair of slopes being driven to connect the older working with the new. The coal is very regular here, averaging about 6 ft. in thickness. Two 150-h.p. steam boilers and a pair of 24x48 winding engines are included in the machinery equipment. A number of new buildings have been erected.

Vancouver-Nanaimo Coal Mining Company.—This company having conceded the demands of the U. M. W. of A., worked full-headed the greater part of the latter half of the year. Its production of coal was larger than in 1912, but there is little else of interest to note.

Nicola Valley and Similkameen.

The Nicola Valley Coal and Coke Co. mined less coal in 1913 than in 1912—110,000 long tons, as against nearly 143,000 tons. On the other hand, the Inland Coal and Coke Co's production figures are 116,000 tons in 1912, as compared with 31,300 tons in 1913. Diamond Vale Collieries continued of little importance as a producer. The Pacific Coast Colliery Co. is reported to have got into good coal.

The Similkameen district, the Princeton Coal and Land Co., made a similar output of coal to its production in 1912. The Columbia Coal and Coke Co. called a halt and sold its property, and the new owners are doing development work in another part of this field. The United Empire Co.'s operations continued unimportant.

The only company from which information was received is the Nicola Valley Coal and Coke Co., a summary follows:

Production for the year is estimated at 111,684 long tons, this being a rather higher total than is used in the accompanying table, but allowance is made in case of a short month's production being made in December. The decrease, as compared with 1912, is accounted for by unfavorable mining conditions (since overcome), in the first half of the year. Mines Nos. 7 and 8 were opened; in No. 7 the main slope is being pushed ahead, with working places being opened as progress is made. This is in a 16-ft. seam of excellent coal. No. 8 is promising, with 6 ft. 6 in. of coal, but development is yet too limited for much to be said of this. Present working conditions allow of an output from this colliery of 750 tons a day, with a gradually increasing capacity, but high railway freight rates so limit the market that output is kept down accordingly. The railway company itself, formerly a good customer, is now burning oil in many of its locomotives instead of coal.

The Inland Coal and Coke Co. has opened a new slope—No. 5, and is active both in developing its property and finding a market for its coal.

Southeast Kootenay Collieries.

Generally, the position at Crowsnest district mines shows improvement. Both The Crowsnest Pass Coal Co. and the Hosmer Mines, Ltd, made a larger production in 1913 than in 1912. The Corbin Co. had to close its No. 1 mine, owing to a fire, from spontaneous combustion; as a consequence, this mine was unproductive during the greater part of the year.

Crowsnest Pass Coal Co.—At Coal Creek colliery, B seam, lying 320 ft. above No. 1 in the Coal Creek measures, was developed to a producing capacity of 500 tons a day. At Michel colliery two new mines were developed on the north side of the valley, and a skip incline was put in to convey the coal from mines to tipple level. The skips or cages carry eight tons of coal down a grade commencing at 30 per cent. and being 60 per cent. at the lower end. The incline is 1280 ft. in length, and the skips, easily controlled by rotary multiple brakes, travel that distance in 80 seconds. These new openings are expected to yield a profitable production throughout the ensuing year. Prospecting on the south side of the valley at Michel resulted in a new seam being found about 150 ft. above No. 3 seam; it shows a working section of about 10 ft. thick of coal of a general good quality.

Output of coal from Coal Creek mines compares favorably with that of the last good year, while the quan-

tity of coke made at the ovens at Fernie is estimated to exceed the previous highest record by nearly 9,700 tons.

Hosmer Mines, Ltd.—There was not any new development work undertaken at Hosmer colliery during the year. The B incline was double-tracked and another drum added to the engine operating it. An 8-ft. diameter Sheldon-Keith wheel fan was provided for ventilating No. 2 B south mine. A steam locomotive was obtained for the rock bank and hauling boiler coal. Production showed a substantial increase—237,500 tons in 1913, against 188,243 in 1912. Coke output was 107,143 long tons, as compared with 45,379 tons in 1912.

Corbin Coal and Coke Co.—No. 4 mine, known as the "Big Showing," was provided with transportation facilities. This mine is situated nearly 1,000 ft. above No. 1, the latter being near the valley level. In No. 1 mine the coal seam is nearly vertical and varies greatly in size. Mr. W. W. Leach described it as varying from a minimum thickness of 10 ft. to a maximum of nearly 250 ft. This great difference may be due to compressed monoclinal folding. At the upper mine the coal has been stripped near the top of the hill and it is shown in a synclinal basin about 370 ft. in width, the thickness of the coal near the centre having been proved by drilling to be more than 100 ft. During the summer and autumn coal in No. 3 mine was worked in open cuts by a steam shovel, and sent down the switchback standard-gauge railway for shipment. The snowfall being heavy, open cut working is not practicable in winter, but about 150 tons of coal a day is being mined here underground. No. 4 mine is a new opening made after fire in No. 1 necessitated the closing of the latter. The seam in No. 4 is a branch off that in No. 1. Present production is at the rate of about 250 tons of coal a day. A Marcus screen has been purchased, but it will not be put in until next spring.

General Notes.

Little progress was made toward the extensive development of the newer coal fields in the province, these being without railway transportation. Some development work was done, both in the Groundhog basin in Northern Skeena and in other fields in the southern part of that district.

The removal of the customs duty on coal entering the United States has not yet made much difference in quantity exported from British Columbia. No doubt it will eventually affect both the Crowsnest district and Vancouver island, but this year the latter has not been able to supply the British Columbia market, the strike of miners having kept down production—in fact, much coal has been imported from the State of Washington and elsewhere to supply demands from the coast cities of British Columbia.

MINE SANITATION

The United States Bureau of Mines is about to investigate the conditions under which a miner works, believing that the unsanitary conditions which exist in some of the mines, as well as in some of the mining towns, are a factor in the death rate among the men. It is intimated that these conditions not only unnecessarily cause the death of miners through disease, but they are often responsible for accidents which might not have happened if the miners were in perfect health.

The bureau has organized what is known as the Mine Sanitation Section, in charge of J. H. White, engineer.

The bureau hopes to bring about progress by appealing to the miner, the manager, and the owner, showing that all three can assist, and how all three can be benefited by good sanitary conditions. It will reach the miner by means of illustrated lectures, moving picture exhibits and pictorial circulars. These will show how sickness and suffering are spread by careless habits, and will drive home the importance of personal and household cleanliness. The bureau will assist the managers by pointing out glaring sanitary menaces, and showing methods and costs of abatement. It will describe in bulletins common unsanitary practices and show the evils which follow in their wake. It will submit sanitary rules and regulations and show the best methods for their enforcement.

Engineer White, in talking about the conditions which exist in mining towns, said: "The mining town does not grow, but is built at a single stroke. The effect of this is that the valuable lessons learned by the 'try-out' method and the profit gained by previous mistakes do not exert their powerful influence, so that the errors existing in one house exist in all; if one house is not properly lighted, none of the houses will be properly lighted; if a few houses are placed too closely together, all houses will be similarly spaced; if there is congestion in one section, there will be congestion throughout. Of course, one could have learned from the experience of other mining towns already built, but this information was perhaps not readily available, and local conditions modify each case.

"One of the first investigations which the bureau intends to take up is the house problem, with a view of putting before the miners the best practices and the ones which have stood the tests of time.

"The company ownership is the most important factor entering into housing conditions. Every house reflects the standard which the operator wishes to maintain. It is difficult to stimulate personal pride among the inhabitants and friendly rivalry is absent. However, if improvements are introduced, they are far-reaching, and the tone of the entire town is raised, so that one house does not point the finger of scorn at its neighbour. The employer being also the landlord means, as a general rule, compulsory payment of rent, and the importance of an assured income should be given due weight.

"In discussing the water supply situation, it must be kept in mind that the town site is generally determined by the location of the mine shaft.

"There are few mining towns with sanitary sewer systems. Such a system presupposes a public water supply for flushing purposes. The approximate location of a mining town is determined by the mine shaft, and the topography must be accepted as it is. This is generally rough and hilly, and a single gravity system of sewers is next to impossible, as the cost of leveling off the hills and grading the streets is prohibitive. Moreover, a suitable stream to take the discharge of the sewers might not be near at hand; and the necessity of installing a sewage disposal plant looms up.

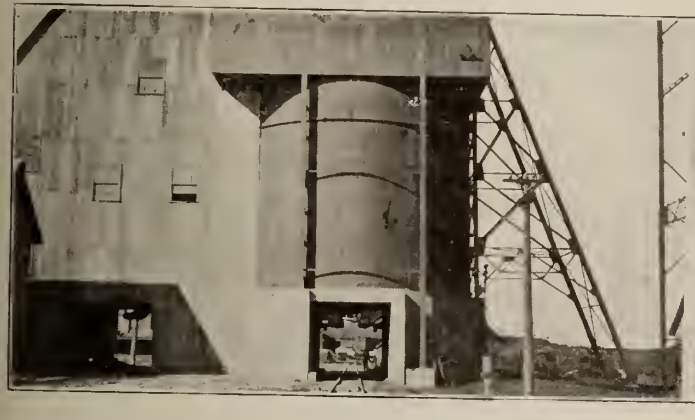
"Mining towns possess many advantages, but the drawback lies in the fact that the initiative in maintaining sanitary and clean conditions throughout the mining town rests entirely with the operator. Indifference on his part may give rise to deplorable unsanitary conditions. The residents have no official voice in the government of the town, and unofficial aggressiveness is seldom exerted, because the total absence of property rights breeds irresponsibility and carelessness. Many of them are blissfully ignorant of the dangers of unsanitary surroundings, and when they protest it is the inconveniences rather than the dangers that bestir them."

ROCK-HOUSE PRACTICE OF THE QUINCY MINING COMPANY*

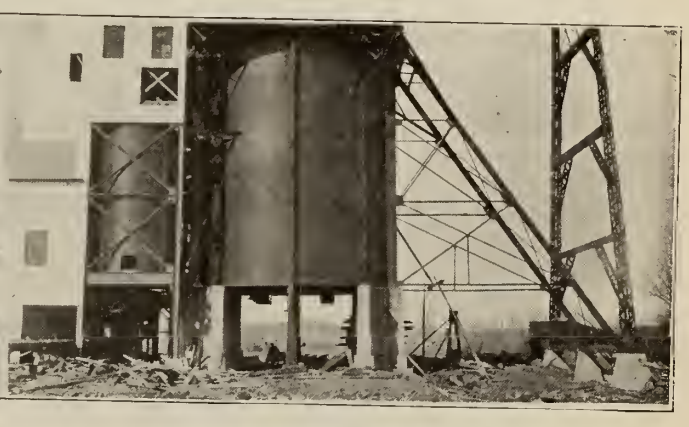
By T. C. DeSollar, Hancock, Mich.

The Lake Superior methods of handling copper rock, as it is locally termed, have undergone many improvements during the past few years, both with respect to underground and surface operations. It is the purpose of this paper to describe briefly the form and mode of operation of one of the combination shaft-rock-houses commonly known as "Rock-house." As the various rock-handling systems in the district work toward the same end—that of crushing copper rock—it is only the intermediate steps that differ from one another in the rock-houses of the various companies. It is thought that the following remarks relating to rock-house practice at the Quincy No. 2 rock-house might be of interest as illustrating a very economical procedure and the best method that has yet been devised by the Quincy Mining Company. Past experience has shown that it is advisable to break the rock to a size that can be advantageously fed into the steam stamps at the mill.

The skip track above the collar of the shaft has an incline of 54 degrees, and the shaft runners are carried up on this angle to the copper rock dump, where there is an outward curve toward the hanging of the shaft for the wider face of the rear skip wheel to travel upon. The 12-foot wood-filled rope sheaves are located 119 feet vertically above the collar of the shaft, and are securely stayed by means of a batter brace. A room located at one side of the collar of the shaft, is occupied by the lander, one of whose duties it is to transmit to the hoist engineer the signals as communicated to him from the underground chute men. The lander without leaving his room moves a sliding plate by means of levers which allow an opening for the narrow face of the front skip wheels to pass through into a track toward the foot of the shaft, the rear skip wheels, which have a wider face, continuing in the plane of the incline and thus dumping the skip.



Quincy No. 2 Rock House



Allouez Rock House

The material, as it is hoisted to the surface, comes in sizes varying from fine material to large masses of native copper, copper rock, and poor rock, weighing at the maximum several hundred pounds.

General Description of Building.

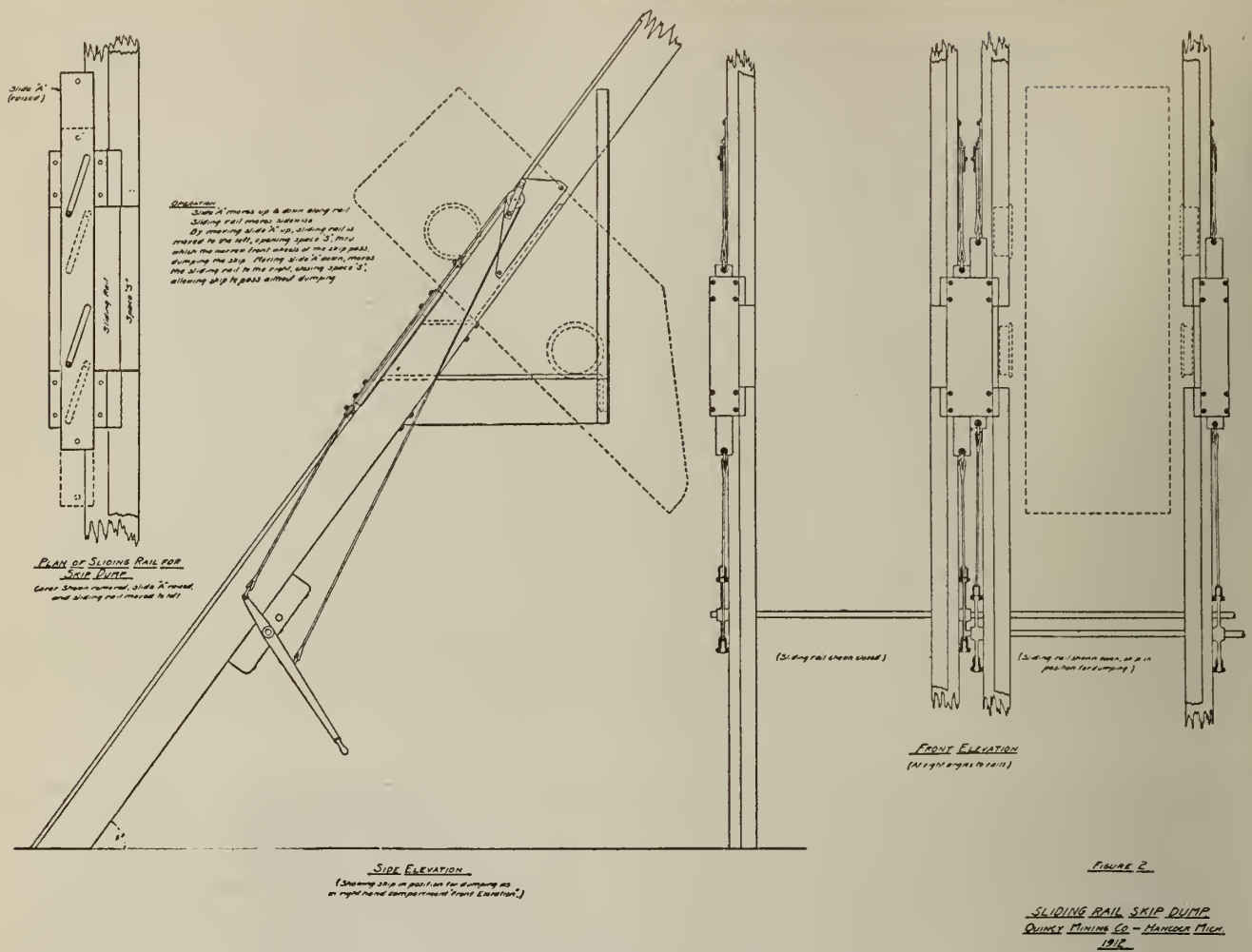
The building is of steel, with corrugated iron roof and sides, and re-inforced concrete foundations and floors, thus making the building absolutely fireproof. All the bins are of steel and are circular in transverse section. The bottoms of the bins, instead of being built up and costly to maintain, are filled with poor rock until the latter assumes an angle of natural slope, thus making its own bed and causing all copper rock dumped into the bins to discharge through the regular openings. The building is 150 feet long, and 30 feet wide except where the large stamp rock bin, 44 feet in diameter, is located. The crusher floor, situated on top of the stamp rock bin 45 feet above the discharge aprons, is of the same size, but square. This bin will hold upwards of 2,000 tons. This large capacity takes care of variations in car supply and rate of hoisting.

There are three points of discharging: The first for mass copper and dull drills; the second for poor rock from sinking shaft, or bottom level cross-cuts; the third, the regular copper rock discharge. A set of levers, one for the first and one for the second, will permit the opening of the discharge as indicated by the signals. An 8x8 inch steam hoist, located in one corner of the building, is for handling timber, cranes and other supplies; also for the track forms used to take a damaged skip or other conveyor, from the skip road. The man-cars, water skip and rock skips are suspended from cranes and can be quickly swung into place and put in operation.

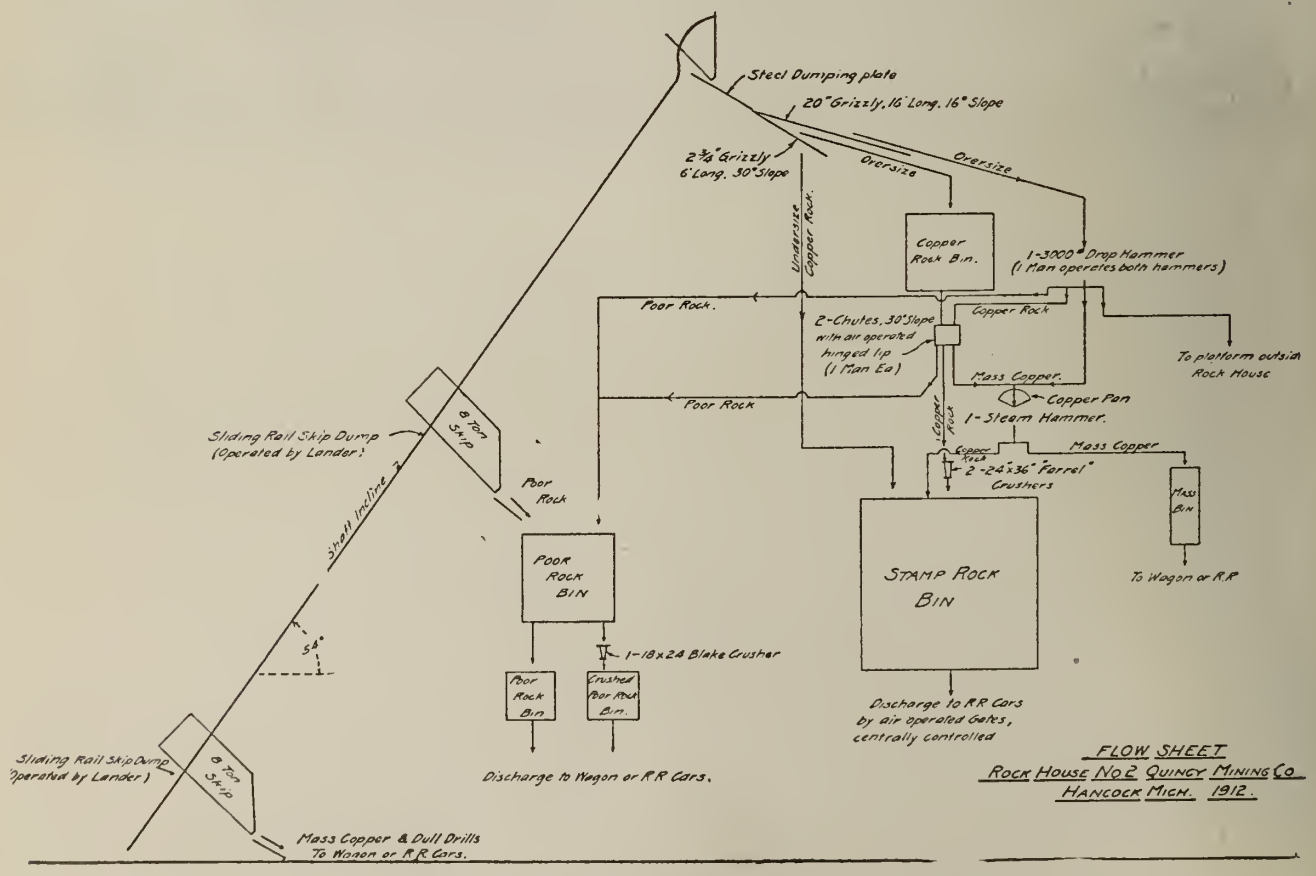
Rock Handling.

The rock is hoisted in two 8-ton skips running in balance. The skips, as before stated, have three discharges. The first discharge handles the large mass copper and dull rock drills. In this dump the skip discharges into a concrete block faced with old rails (flange up) having a slope of 30 degrees. This slope changes to level and forms a platform of the right height for loading the mass copper onto a railroad flat

*Prepared for Houghton Meeting of the Lake Superior Mining Institute. Published in Transactions, Vol. XVII., pp. 217-226. Photos by R. E. Hore.


Slide 'A' (raised)
Sliding Rail
Space 'S'
Operation:
Slide 'A' moves up & down along rail
Sliding rail moves sideways
By moving slide 'A' up, sliding rail is moved to the left, opening space 'S' thru which the narrow front wheels of the skip pass, dumping the skip. Moving slide 'A' down, moves the sliding rail to the right, closing space 'S', allowing skip to pass without dumping
Plan of Sliding Rail for Skip Dump
Cover Shown removed, slide 'A' raised, and sliding rail moved to left
Side Elevation
(Showing skip in position for dumping as on right hand compartment Front Elevation.)
(Sliding rail shown raised)
(Sliding rail shown down, as in position for dumping)
Front Elevation
(At right angles to rails)
Figure 2.
Sliding Rail Skip Dump
Quincy Mining Co - Hancock Mich.
1912

Sliding Rail Skip Dump, Quincy Mining Co.



Flow Sheet, Rock House No. 2, Quincy Mining Co.

car. Masses weighing up to eight tons are loaded upon the railroad cars by means of 8-ton chain blocks hung from trolleys in either compartment carried by 18-inch 55-pound I-beams extending out over the railroad track. The dull drills are easily loaded onto a wagon or car and taken to the drill shop to be sharpened, while the mass copper is shipped directly to smelter.

When poor rock is hoisted from shaft sinking or the bottom level cross-cuts, the second dump is opened by means of the above described levers and the skip discharges into a reinforced concrete chute, which empties into a cylindrical steel bin 13 feet in diameter. This rock is drawn off by two chutes, one of which feeds a 24x18 inch Blake type rock crusher, where the rock is crushed to a size adapted for concrete, or road work. Under the crusher is a cylindrical steel bin 9 feet in diameter, where it can be loaded from a chute into railroad cars or wagons. The chute on the opposite side of the 13-foot bin permits the discharge of the coarse rock directly into a vertical cylindrical steel tube 5 feet in diameter, dropping upon a reinforced concrete block slightly inclined, which breaks the fall, and from which it can be loaded through a chute into railroad cars or wagons.

When copper rock is hoisted, the third, or regular, discharge is used and was made as above described in order that the lip of the skip might remain in a position close to the steel dumping plate and not cause the rock to be violently thrown from the skip. It might be stated that the copper rock dump was designed in order that the skip should discharge into a pocket which would fill until the rock took its natural slope, the rock then discharing onto the grizzlies. It was found during the erection of the building that there was a mistake of about three feet between the blue prints and the steel construction, and a steel dumping plate was substituted.

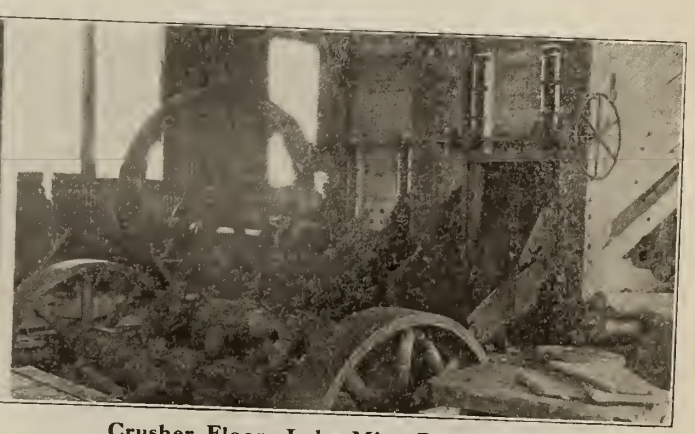
The dumping plate spreads the rock upon 6-inch steel grizzly bars approximately 16 feet long, set at 16 degrees, and having 20-inch openings. Immediately above the grizzly bars is a battery of heavy bars, which serves the double purpose of breaking the fall of the rock and spreading the same upon the grizzlies.

Two Views Showing Skip Roads, Man-Car and Bailer. Quincy Mine, No. 6 Shaft.

The oversize from the grizzlies passes down to a reinforced concrete chute, striking a second battery of bars, then drops vertically into a bin having its side open toward a 3,000 pound drop hammer. Between bin and hammer is a 15-inch, 42-pound I-beam carrying a travelling 8-inch 2-ton air lift. This I-beam is bent in the shape of a horseshoe and permits the air lift to be used at either crusher, or poor rock chute. Here the oversize, if mass copper, is cleaned of the poor rock under the hammer; if copper rock, it is broken to a size that can be handled by the crushers, or, if poor rock, it is thrown into a chute leading to the poor rock bin.

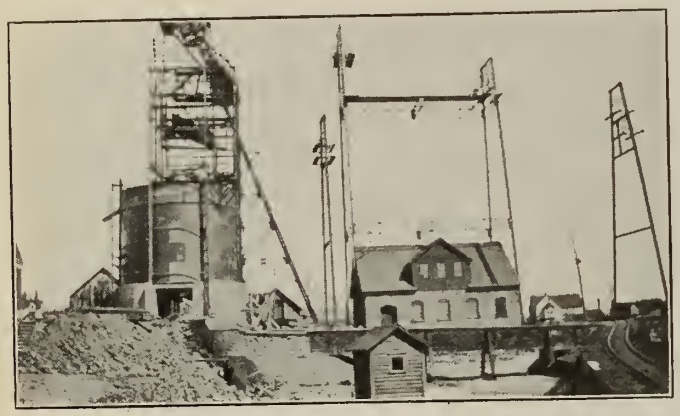
In case the broken oversize is small mass copper, it is thrown into a mass copper chute leading into a cylindrical steel bin 6 feet 8 inches in diameter, which discharges into railroad cars. If it is mass copper too large for this chute, it is loaded onto a pan, swung from a crane, and lowered outside the building to a reinforced concrete platform at the right elevation for loading on a railroad flat car.

Crusher Floor, Tamarack Rock House.



Crusher Floor, Lake Mine Rock House.

The undersize from the 20-inch grizzlies falls upon a second grizzly composed of 3½ inch steel bars, 6 feet long, set at 30 degrees, and having 2¾ inch openings. The undersize from these last grizzlies passes directly into the stamp rock bin below the crusher floor. The oversize is discharged into a cylindrical steel bin 14 feet in diameter holding approximately 10 skip loads of rock. The outlet from this bin is by two chutes 19 feet apart. Vertically sliding steel doors, 4x4½ feet, with replaceable steel linings, operated by 6x36 inch air cylinders, control the feed into steel chutes set



No. 2 Rock House, Quincy Mine, During Construction.

at 30 degrees. This feed is directed into the two 36x24 inch Blake type rock crushers and regulated by a hinged apron, which is operated by a 6x18 inch air cylinder. One man at each chute feeds the crusher, picks out the poor rock and mass. The poor rock goes into a chute leading to the poor rock bin. The mass is stored upon an inclined semi-circular chute called the "Copper Pan," on which it easily slides to a small steam hammer, is cleaned from poor rock, and thrown into a chute leading to the mass copper bin. This steam hammer is run by a third man, who handles the trolley already described, cleans the mass copper, oils and has charge of the machinery.

The crusher jaws are made of manganese steel, and are set to crush to three inches. The crushers running

Quincy 7 Ton Skip.

at 140 r.p.m. are operated by a 12x24 inch Nordberg Corliss valve steam engine running at 110 r.p.m. A 75 h.p. electric motor occupying less space is installed, and is ready to run in case of a break down to the engine.

The rock from the stamp rock bin is loaded into railroad cars for the mill by means of discharge aprons operated by 5x13 inch air cylinders.

Three men handle upwards of 1,000 tons of rock every 12-hour shift, change man-cars and skips on skip-road, and load all timber and supplies that are lowered underground. Between shifts, when the large mine air compressors are not in operation, power for the operation of the air lifts and air controls is furnished by a small 11x11x12 inch Westinghouse air pump, so arranged that when the air pressure from the mine compressor drops, the air pump automatically starts. A combination of check valves prevents loss of this air into the underground system and, likewise, when the air pressure from the compressor is raised, the air pump is automatically stopped. This system of handling material has shown an average rock-house cost of less than two cents per ton.

CLAYS AND CLAY PRODUCTS.

Clays or shales suitable for the manufacture of ordinary common and pressed building brick, pottery, tile, sewer pipe, etc., are found widely distributed in almost every province of Canada, and are being utilized wherever there is a demand or a market for clay products. Fire clays or clays suitable for the manufacture of firebrick have been found at only a comparatively few points, including Shubenacadie, N.S., Dirt Hills, Sask., and Clayburn, B.C., and as yet are utilized to a comparatively limited extent only.

Kaolin or china-clay has been found in the county of Argenteuil, Province of Quebec, near St. Remi de Amherst, and a washing plant has been erected for the preparation of the material. The extent and importance of the clay working industry is shown by the value of the production which, in 1912, exceeded $9,000,000, and amongst non-metallic products was next in importance to coal. The consumption probably exceeds this value by at least one-third, owing to the large imports, particularly of firebrick and of earthenware and chinaware.

BOUNTIES ON MINERAL PRODUCTION.

The Dominion Government at the present time offers bounties on the production of petroleum and lead.

The bounty paid on petroleum is at the rate of 1½ cents per Imperial gallon on crude petroleum produced from wells in Canada, and the bounty is payable under the conditions and regulations provided in the "Petroleum Bounty Act."

The "Lead Bounty Act" of 1908 provided for the payment of a bounty on lead contained in lead ores mined in Canada and shipped to a Canadian smelter, at the rate of 75 cents per hundred pounds, or approximately £3 10s. per ton of 2,240 pounds, subject to the restriction, that when the price of lead in London exceeds £14, the bounty shall be reduced by such excess. This Act has been renewed in 1913 for a further period of five years. The bounty is payable subject to the terms of the Act and of the regulations provided thereunder.

Bounties were formerly paid on the production of iron and steel, but these expired automatically in 1912 and have not been renewed.

The administration of the Dominion Bounty Acts is under the direction of the Minister of Trade and Commerce, and full information in respect thereto may be had from the Deputy Minister of Trade and Commerce, Ottawa.

WESTERN FEDERATION STRIKE IN MICHIGAN

The Christmas Eve Calamity at Calumet.

Houghton, December 25.

The Christmas season, usually one of joy, is a season of mourning, a season of grief for the whole people of the copper country. A season that usually is blessed with recounting the birth and sweet works of one who came into this world to save little children and big men and women, is immeasurably saddened, for 50 of these little children and 30 men and women lie dead in Red Jacket, children, men and women, who died while attending Christmas tree exercises for the families of the striking mine workers of the Western Federation of Miners. The calamity took place early yesterday evening in the Italian hall on Seventh Street, Red Jacket.

The whole district lies stunned, saddened with grief, following a night during which the people of the community were paralyzed by the horror of the wholesale killing.

Upon the cry of "Fire" little children by the hundreds and women attempted to pile out into the hallway and down the stairs through the narrow exit, the door of which opens outward.

Little children who could not move fast enough to get out of the way of those coming behind were crushed and smothered beneath the weight piling down upon them. The majority were smothered to death. The outside door was opened by passersby, but the children and women were so solidly packed at the bottom of the stairs and halfway to the top of the single flight that they could not be pulled out.

In the meantime others within the building poured out over the bodies of the crushed and lifeless at the bottom of the stairs, using them as a roadway to escape from the building. So solidly were the bodies at the bottom of the stairs packed that it was necessary for the firemen and deputy sheriffs to go into the second-storey windows with ladders and to come down the stairs and pull the children back off the pile.

The awful slaughter was stopped only when the deputies appeared in the hall at the top of the stairs and forcibly prevented more from piling upon those below. It took two hours to clear the hallway, many in the pile dying while being taken out.

The first on the scene to help in the work of rescue were citizens who were attracted by the fire alarm. Many of the bodies were snatched away by grief-maddened parents, as the lifeless little forms lay on the floor of the hall, and were taken to their homes, so the full number likely is not accounted for in the list published.

Seventy bodies were taken to the temporary morgue established in the Red Jacket town hall, where identifications were made as rapidly as possible. Clamoring about the building was a crowd of several thousand people, including hundreds of women. Many whose children were at first thought to be among the dead later found their little ones in the crowd or at home.

President Moyer, of Western Federation, Hastens to Spread False Reports.

Houghton, December 25.

President Charles H. Moyer, of the Western Federation of Miners, said of the catastrophe that he had telegraphed President Wilson, Governor Ferris, Secretary Morrison, of the American Federation of Labor, acquainting them with the details of the disaster and urging and requesting them to bring about immediate national and state investigation into the cause of the disaster. His information, he says, is to the effect that no striker or person in sympathy with the strike brought about the catastrophe.

There are many, he says, who will testify that a man from the outside came up the stairs of the Italian hall and called out "Fire." There are others who will testify that he wore a Citizens' Alliance button. He also says that he has noticed that public meetings are to be held in Calumet and Laurium to take steps for the relief of the victims and for the burial of the dead.

He wishes to say that the Western Federation of Miners will bury its own dead and that the American labor movement will take care of the relatives of the deceased and that no aid will be accepted from any meeting of citizens who a short time ago met and pronounced "these people" undesirable as citizens of this district.

The meetings referred to in this statement by Moyer were those called by the Citizens' Alliance, following the murder at Painsdale of three non-union men three weeks ago Sunday, while the victims slept in bed. The meetings were held at Houghton and Calumet, and adopted resolutions to the effect that the Western Federation agitators should leave the district.

This attempt on the part of the strike leader to make capital out of the terrible calamity generally was resented throughout the district last night.

The citizens certainly agree that the most searching and detailed investigation of the whole terrible calamity should and must be made so that every fact connected therewith will be brought to the public's attention and the perpetrators and instigators of the disaster speedily brought to justice and punished to the full limit of the law.

It is generally known that no members of the Citizens' Alliance or any others that were not identified members of the Western Federation of Miners or their families and carried their cards possibly could gain admittance to any of the meetings in the hall.

The Facts.

Houghton, January 1.

After considering for more than six hours the evidence submitted before them in the coroner's inquest into the death of seventy-four persons in the Italian hall panic Christmas Eve, the coroner's jury last night returned a verdict declaring that the deaths of the deceased were caused by suffocation in a panic caused by some person "raising an alarm of fire within the hall."

The jury also took occasion to commend the citizens, doctors, firemen and members of the sheriff's force for their prompt action in rescue work and relief of suffering.

The jury returned its verdict shortly after 8 o'clock. The verdict in full follows:

"We find that the said Herman Ala and seventy-three others came to their deaths on the twenty-fourth day of December, nineteen-thirteen, at the Italian hall in the village of Red Jacket. We find by the evidence of the witnesses that the cause of the deaths of the above-named persons was suffocation, the same being caused by their being jammed in the stairway leading to the entrance of the Italian hall, where a Christmas celebration was being held under the auspices of the

Woman's Auxiliary of the Western Federation of Miners, and the stampede was caused by some person or persons, unknown to the jury at this time, raising an alarm of fire within the hall, and we further find that no person or persons were allowed inside the hall where the celebration was being held without producing a union card or having some member of the union vouch for them before they were allowed admittance. We further find by the evidence that the citizens, doctors, firemen and the sheriff's force are to be commended for their prompt action in their efforts to relieve the suffering.—(Signed) Burton Barnham (chairman), Jacob Pesonen, Matt Chop, Dan Yauch, Jacob Talso, George Talbot; William Fisher, coroner."

Moyer Deported.

Houghton, December 27.

Charles H. Moyer, president of the Western Federation of Miners, left the copper country last night. The occasion for his abrupt departure was not made public, and inquiries up to a late hour last night revealed little definite information on the matter.

The siren on the Houghton County Electric Light Company's power station in Houghton blew an alarm at 9.30 o'clock and a big crowd gathered at the Copper Range station on the rumor that Moyer was aboard the train going out at that hour. It was learned later that the whistle was blown because of an unfounded rumor of a riot at Calumet.

The only information that seems to be authentic was that Moyer was visited at his room in the Scott Hotel, Hancock, about 9 o'clock, that some kind of an altercation took place and that immediately Moyer and another man, evidently an associate, went to the Copper Range station in Houghton and there boarded the train, accompanied by three persons who seemed to be guarding them.

It was generally talked around the streets that Moyer's departure is permanent and is based on his fear that his attitude in the Calumet disaster might bring about reprisals from enraged citizens.

Sheriff Cruse and his detectives spent the night in an investigation of the occurrence. The sheriff declared he would make a thorough probe of all the circumstances of Moyer's departure.

Report on Interview With Charles Moyer.

Houghton. December 28.

Concerning the visit made to President Charles H. Moyer, by representatives of the citizens' relief committee in his headquarters Friday night for the purpose of pleading with him to permit the suffering and starving families of the survivors to accept relief from the citizens, the committee issued a statement yesterday afternoon. The committee interviewing Moyer was made up of President Joseph Wills, of Laurium; President Frank H. Schumaker, of Red Jacket; John H. Rice, of Houghton; James T. Fisher, of Laurium, and A. E. Petermann and M. A. Thometz, of Calumet. Moyer refused, point blank, to permit the giving of aid to the sufferers. The committee issued the following report:

This committee was named by the relief committee and they sought to prevail upon him the immediate need of aid. Every effort was met with rebuff.

The committee told Mr. Moyer of the meeting in Calumet, December 25, to devise ways and means of raising money to alleviate the suffering of the victims; that a committee of twelve was appointed to carry on the work; that the committee had already received contributions of upwards of $25,000; that they had spent the day in canvassing the situation and in sending out sub-committees to offer assistance to the families who had been injured; that some of these committees consisted of the leading women of Calumet and were of different nationalities so as to reach the stricken people and talk to them in their own language.

The committees, Mr. Moyer was informed, reported that in every instance they were informed that no assistance would be accepted unless it came from people with a union card. The reports as received from all the committees were about the same. The stricken refused absolutely to accept aid from the citizen's committee, saying they had been instructed by the union not to accept aid or relief in any manner from the citizens. Many of these families were destitute, in need of clothes and food. Some wished to accept, but were afraid to do so on account of the orders of the union agents. In one instance, a committee of ladies was ordered from a house. During the afternoon, the committees reported that in almost every instance, people other than members of the families of the afflicted were present and that it was next to impossible to reach the families; that in several of these homes, the families wanted the assistance of the committee, but said they were actually afraid to accept it. The committees reported that there were several families who said they could well take care of their dead without assistance from the union or the relief committee and preferred to do so. A few families refused point blank to take any aid whatever from these committees, but a great many of these families would accept relief if it could be done without the knowledge of the Federation.

The committee told Mr. Moyer that they believed he was not actually aware of the exact conditions that existed among the families. They cited instances of extreme poverty and of the absolute need of immediate aid, regardless of its source. They said they came to ask him, the man they believed to be the responsible head in this district of the Federation, to allow these families to accept the aid which was offered to them by the citizens of the county. He was informed that there had been raised more than $25,000 with which to aid these people and all they asked of him was to issue a statement that this aid should be or could be accepted by the afflicted.

"We are not representing the Citizens' Alliance or any corporation," said the spokesman of the committee. "We are here simply as members of the relief committee who are asking you to allow these poor, stricken families the privilege of accepting our aid."

As to a response to this question, Moyer was evasive but upon being pinned to answer "yes" or "no" on the question of issuing a statement that these people should accept this aid, the answer was "no." Moyer was then asked whether he was the responsible head of the Federation in the district and responsible for the orders issued, and, if not, who was. To this question he replied: "I refuse to answer."

The ladies' relief committee has visited the homes of fifty-four families, and almost in each instance, immediate need for assistance was evident. Another Calumet woman who was personally investigating cases of destitution and who has been a friend of the families for many years, asserted that many of the scenes are nothing short of inhuman neglect on the part of the agitators. Numerous cases of poverty were told by this woman who asserts that the strike benefits were

insufficient to provide for any family. Many of the little ones were without underwear and there was barely any food in the houses.

General Manager MacNaughton Falsely Accused by Moyer and Hilton.

Chicago, December 27.

Attorney Hilton, of the Western Federation, questioned concerning statements made by Mr. Moyer concerning Mr. MacNaughton, said:

"There is no doubt about it. Moyer could not have been mistaken. He knows Jim MacNaughton like his own mother, has seen him constantly since the negotiations for a settlement of the strike have been on. MacNaughton and Moyer have been in conferences which I personally attended. MacNaughton ordered him out of the country, said he would hang him if he returned, and then he searched him. Two gun men held him and MacNaughton took two wallets from Moyer's person.

Two One-Man Machines (Jackhamers), Osceola Lode, Calumet and Hecla Mine, Mich.

One of these contained money and this he returned. He kept the other."

According to Moyer and Tanner, the attack occurred at about 8.10 or 8.15 o'clock and they were thrust aboard the train an hour or so later—they were not sure.

According to several of MacNaughton's friends he was in Calumet, twelve miles from Hancock, at 9.45 o'clock. The train is scheduled to leave Hancock at 9.27 o'clock.

Associates of MacNaughton in Calumet state that he has never even met Moyer, that he has constantly refused to have any conferences with him or with any other officers of the Federation of Miners and that Attorney Hilton knows these facts well, as does every copper country person acquainted with the strike situation.

MacNaughton gave out the following statement to an Associated Press reporter at Calumet to-day:

"Any charge by Mr. Moyer that I had any part in the occurrences of last night at Hancock is absolutely and unqualifiedly false. I spent the evening in Calumet, accompanying my wife in calling on friends, and later walking across the street from their home to the Miscowaubik Club for a chat with some gentlemen. I certainly could not have been in Hancock at the hour indicated."

Henry Brett, at whose residence Mr. and Mrs. MacNaughton spent Friday evening, stated: "Mr. MacNaughton, accompanied by his wife, called at our home shortly after 8 in the evening. They remained all evening. About 10 o'clock we went across the street to the Miscowaubik Club and returned to my home at 11. I know positively that Mr. MacNaughton was not in Hancock at any time Friday evening."

Mr. Denton Explains Uselessness of Entertaining Proposals of Strike Bosses.

Houghton, December 31.

General Manager F. W. Denton, of the Copper Range Consolidated Mining Company, yesterday reviewed the strike situation from the side of the companies and of the men now working for the benefit of visiting and local newspapermen.

Mr. Denton discussed the matter very freely, because he believes that national interest now aroused calls for the very frankest discussions of the questions involved. His talk covered a period of two hours and would involve a voluminous transcription, including many facts already perfectly known. In general he made this statement:

"The companies could not now treat with the Western Federation of Miners if they would. The men now at work would not stand for it. The introduction into these mines of men holding Federation membership cards and paying allegiance to that organization simply would mean trouble underground. The two classes of men would not mix."

The Various Issues.

Mr. Denton showed that the controversy now has narrowed down to the question of recognition of the Western Federation of Miners and the consent of the companies to treating with that organization. He explained the concessions made to the men, how the one-man drill never was an issue really, how the establishment of a nominal eight-hour time schedule was brought about only after influence was brought to bear by the companies themselves on the miners, who actually did not want this schedule, though the trammers did.

Small Minority in Federation.

Asked as to the various arbitration proposals, Mr. Denton said they could not be considered, simply because they would mean treating directly or indirectly with an organization that has no rights in the district.

"If this organization represented a majority of our workers at the time it called the strike, there might be some justice in asking us to treat with it. But this organization I firmly believe did not number one-tenth of the workers of this district when it called the strike. The mines now have 10,000 men working and it certainly does not represent them. It does represent about 2,500 strikers at this time. Is it right for us to submit to the representative of 2,500 men when 10,000 men now employed refuse such representation?"

Guerrilla Warfare.

Mr. Denton explained the operations of the Western Federation of Miners as he had seen them in actual practice. He said that after the strike had been in progress for weeks, after fully 50 per cent. of his former employees had been driven from the location by intimidation, some of his men began to come back to work. Then began the campaign of guerrilla warfare.

A house in which lived a number of Lithuanians was shot up, six bullets having pierced it. The return to work was checked.

There was peace again for a time and former employees again took heart and began to return to work and then occurred the murders of Thomas Dally and the Jane brothers. Mr. Denton characterized these murders as a deliberate enterprise for the stopping or checking of the return to work movement and he admitted that it was an effectual check. That was three weeks ago and it was not till Monday of this week that more men began coming in looking for work.

Government Investigators.

Referring to Government investigations, Mr. Denton said that he and the other managers threw their books open to the investigators, to Mr. Moffitt and to Mr. Palmer. The managers suggested that the only manner in which the right of the Western Federation of Miners in this district could be shown was for that organization to be equally frank and to show how many actual members, by its books, it had in this district at the time of the calling of the strike, July 23. The investigators, as far as Mr. Denton ever has been able to learn, did not try to gain access to the Western Federation of Miners' books, or, if they did, they were not successful. No reports of their investigations have been made public.

Mr. Denton takes the stand that only about ten per cent. of the miners of the district have consented to permitting the Western Federation of Miners to act for them and that this small proportion is not enough to override the rights of the great bulk of the workers. He insists that the matter has now gone too far, that the companies have proven that the Federation has no status here as representing the workers, but rather that the workers do not want the Federation recognized.

PHOTO BY O. GARDNER

Miner Working on 65th Level, Conglomerate Lode, Calumet and Hecla Mine, Calumet
The Drill is a One-Man (Butterfly C113) Machine.

that they would not accede to it even if the companies would.

Western Federation Will Not be Recognized by Mine Operators.

Houghton, January 3.

There were practically no new features in the strike situation yesterday. At all of the mines reports indicated that there were additions to the working forces, although not in any substantial numbers. Inasmuch as the business interests of the community importuned the mining companies to extend the time for the return to work limitations to January 1, the business people generally now have come to the conclusion that the men still on strike do not desire to work. As a matter of fact, these same business interests now believe that it

would be for the best interest of the district for the mining companies to bring in as many workmen from outside as are needed.

This strike is over as far as the copper mining companies are concerned, and as far as the remaining strikers are concerned, as the latter have forfeited any claim they might have had to their jobs and they may just as well go elsewhere looking for work, as far as their standing with their former employers is concerned.

It is the understanding that the mining companies now will import men to take the places of the strikers.

The Calumet & Hecla does not need to do this. That company, in the Calumet & Hecla mines proper, needs no men. It has a full force. There were applications at the Calumet & Hecla mines yesterday by twenty-two former employees for work and by a number of new men. They were all sent to subsidiary companies, such as the Osceola, Kearsarge, Tamarack, Ahmeek. At Baltic the additions to the working force permitted night shift operations to commence at the No. 3 shaft. Quincy added some men.

It is not believed the companies will find it necessary to go out after men, but that men will come seeking jobs. Of course the Western Federation of Miners is picketing the Chicago railroad stations and trying to prevent men from coming to the copper country, but they are coming, in groups of five, ten, a dozen, twenty. Every railroad station in the copper country sees these little groups of work seekers every day.

It is true that comparatively only a few strikers tried to get their jobs back yesterday, which was the last day left open to them by the companies. At Mohawk, for example, 100 strikers had signed an agreement to go back, but only a very small part of the number carried out the agreement.

At the meeting in Hancock Thursday, at Kansankoti hall, the strikers voted not to return to work and there were, it is estimated, 1,200 of them there. They probably represented about an equal number of absentees, so that the strike will not end by that route.

There is no doubt that the Western Federation of Miners is trying to close up the matter with as much credit to itself as possible. The leaders here, Attorney Hilton and Claude Taylor, the latter a volunteer, as he has no interest as a labor leader, being president of the Michigan Federation of Labor, are talking settlement.

The lexicon of the copper mining companies contains no such word as "settlement." There absolutely and positively is no plan that the Western Federation of Miners could bring forward that the companies would consider, that the businessmen and the working miners of the copper country would have them consider.

On second thought there is one plan—if the Western Federation of Miners will leave the Michigan copper district, close up its union offices, dissolve the charters of the local unions, turn in all the membership cards of the men and get out of the district absolutely, the copper companies would look upon that as a settlement of the strike, little as the Federation might be satisfied with that view of it.

C. & H. Will Not Recognize Western Federation.

Boston, Mass., January 3.

The Calumet & Hecla Mining Company will continue to refuse recognition to the Western Federation of Miners and to refuse to employ its members, officers of the company declared in a statement to-night regarding the strike at their mines.

"The copper country," said the statement, "has for fifty years enjoyed industrial peace, and our relations with our men have been mutually satisfactory. We never have discriminated and do not now discriminate in employment between those who do and those who do not belong to labor organizations.

"We have, however, during the pending strike, refused, and must continue to refuse, to give recognition to the Western Federation of Miners or to employ its members, for reasons peculiar to that organization."

The statement severely arraigned the policy of the Federation, adding:

"The great majority of the employees have voluntarily and spontaneously petitioned us never to recognize this organization or employ its members."

The statement also said:

"The company, with all the officers and employees of the mines, joins in deploring the tragic accident which destroyed the Christmas happiness of so many of our fellow citizens, and we have been anxious and ready to give every assistance to our stricken fellows that lies within our power.

"The company will continue to do everything in its power to contribute to the safety, comfort and happiness of its employees. On December 1, 1913, an eight-hour day for underground employees and a nine-hour day for surface men were put into effect. The general manager set aside a fixed day every week for hearing complaints and grievances among the men individually or through committees. These improvements are not suggested or hastened by present conditions, but are a part of a fixed programme of progressive improvement which always has marked and always will continue to mark the policy of the company.

"The company desires and will endeavor to make hours, wages and working conditions equal or superior to those obtaining in any copper mines at home or abroad."

The Companies' Stand.

Houghton, January 8.

The companies told the Governor, through Allen F. Rees, senior counsel for the Calumet & Hecla and for all of them in joint legal issues, that the only basis for the settlement of this strike is the return of the men to work after throwing away their union cards, and, further, that the companies adhere to such proposals as were made to Judge Murphy, the Governor's personal representative, early in the strike.

Mr. Rees said, in substance:

"I regret we had no intimation that such a statement might be called for or it might have been prepared in concise form.

"At the time a communication from officers of the Western Federation of Miners was received each company without co-operation, tried to ascertain if the Federation of Miners was justified in claiming to represent the employees. The result of the investigation, by census and by other means, was that less than 25 per cent. of the employees were members of the Federation or had authorized it to represent them. For that reason the companies took the position that the Federation was not justified in its claims. The communication said there must be an answer within ten days or no peaceful settlement of the claims could be brought about. The communication did not specify claims or grievances.

"The strike began July 23. In one mine employing 160 men only two or three struck. The other mines showed similar but slightly varying proportions. The

majority of the men reported for work and continued that day. The night shift men came on to work also in large proportion, but then the rioting broke out and the men were driven from the mines by the strikers. I will not detail the occurrences of the strike."

Mr. Rees referred to the arrival of the State troops and paid them a tribute for conduct and efficiency. Under their protection, he said, 75 per cent. of the employees of the Calumet & Hecla returned to work. "This return to work confirmed the attitude of the companies," said Mr. Rees, "that the Western Federation of Miners did not represent the body of the employees. The position then was taken that the companies would have nothing to do with the Federation. This position is based on the history of the organization in other districts, on the conviction that it is to the interest both of the companies and of the employees that this Federation does not procure the domination of labor in this district."

8,724 Men Now at Work Underground.

Houghton, January 9.

Governor W. N. Ferris announced at yesterday's investigation the figures of Labor Commissioner Cunningham on the number of men employed underground in the mines of the copper country as compared with the number so employed before the strike.

The table follows:

Company.	No. employed before strike.	No. employed now.
Isle Royale	709	295
Centennial	117	135
Superior	162	146
Laurium	25	0
Champion	1,118	594
Quincy	1,580	1,242
Trimountain	570	349
Baltic	960	328
Osceola	1,143	548
Tamarack	591	112
Wolverine	333	106
Calumet & Hecla	4,107	4,203
Hancock, Cons.	161	94
Mohawk	686	103
Ahmeek	582	246
LaSalle	43	29
Allouez	305	171
Franklin	322	23
Totals	13,514	8,724

Attorney A. E. Petermann, speaking for the Calumet & Hecla, said there are on the payrolls of the company 287 men not included in the figures given, who are sick or receiving benefits or were taking a day off on January 6, the day the figures were compiled.

The Governor inquired and learned there are no "gun men" or deputies, office men, mill men, smelter men or any men but underground workers, included in these figures. There also are 150 old employees of the Calumet & Hecla who are working as watchmen and not listed.

Governor Ferris yesterday continued his quest for information regarding the copper strike and he learned among other things this salient fact:

The copper companies operating in the upper peninsula of Michigan, through their personal representatives on the properties, are not opposed to organizations of laboring men as such, but they are opposed to organizations that teach class hatred, that will not consider labor and capital as partners; to organizations that are officered and conducted in such a manner as it appears to them the Western Federation of Miners is officered and conducted. Finally, the companies are opposed to this particular organization, the Western Federation of Miners, and will not treat with it directly nor indirectly.

PENNSYLVANIA ANTHRACITE.

According to Edward W. Parker, of the U. S. G. S., the production of anthracite in Pennsylvania in 1912 amounted to 75,322,855 long tons, valued at $177,622,626, a decrease in quantity, as compared with 1911, of 5,448,633 long tons, or 6.7 per cent. Notwithstanding the smaller production, the value exhibited an increase of $2,670,021, or 1.6 per cent. The smaller production in 1912 was due entirely to the suspension of mining operations on April 1, pending the settlement of certain demands by the miners for changes in the agreement under which work had been carried on during the three previous years. The suspension was practically complete during the entire month of April and most of May. The modified agreement was signed on May 20, and operations were resumed at once. The total production for the month was only about 1,500,000 tons, or approximately one-fourth the normal output. A part of the shortage created by the suspension was partly made up by increased activity in March, in anticipation of the shutdown, and also after operations were resumed, particularly in July, August, and October. In three of these months, namely March, August and October, "record" outputs were made, the railroad shipments for each of the three months exceeding 6,500,000 tons. The previous high record was in March, 1909, when the shipments amounted to 6,333,000 tons. Notwithstanding the loss of time due to the suspension the average working time was only 15 days less than that of 1911.

Of the total production of 75,322,855 long tons in 1912, 65,229,255 long tons or 86.6 per cent. was loaded at the mines for shipment to distant points; 2,113,904 tons or 2.8 per cent. was sold to local trade or used by employees, and 7,979,696 tons, or 10.6 per cent. was consumed in the generation of heat and power at the collieries.

The circular prices for the several sizes of anthracite at the mines in 1910, 1911, and 1912, which are common to all the region, were as follows:

Circular Prices for Anthracite at the Mines, 1910-1912, Per Long Ton.

Size	1910	1911	1912
Lump	$3.50	$3.50	$3.50
Steamboat	3.00	3.00	3.00
Broken (furnace)	*3.50	*3.50	†3.50
Egg	*3.75	*3.75	†4.00
Stove	*3.75	*3.75	†4.15
Chestnut	*3.75	*4.00	†4.15
Pea	2.00	2.00	2.50
Buckwheat	1.50	1.50	1.50
Rice	....	‡.538	‡.634
Barley	....	‡.339	‡.388

*Subject to 50 cents reduction in April, 40 cents in May, 30 cents in June, 20 cents in July, and 10 cents in August.

†Discounts omitted in April and May, but resumed in June.

‡Average price received for all coal of these sizes sold by Philadelphia & Reading Coal & Iron Co.

HUDSON BAY EXPLORING EXPEDITION, 1912*

By J. B. Tyrrell.

On the 18th of April, 1912, I received instructions from The Honourable the Minister of Lands, Forests and Mines of the Province of Ontario, to organize a party, including a properly qualified Dominion Land Surveyor and assistants, and to proceed at as early a date as practicable direct to Port Nelson at the mouth of the Nelson river on Hudson Bay, and after due investigation to carefully select the lands, waterfront and easements to which the Province of Ontario is entitled under an agreement with the Province of Manitoba, ratified by an Order of the Privy Council of the Dominion of Canada, dated the twentieth of February, 1912.

After these lands had been selected, they were to be properly and accurately surveyed.

As much information as possible was to be obtained about the strip of country lying within fifty miles of the shore of Hudson Bay and extending from the southeastern bank of Nelson river to the western boundary of the Province of Ontario.

And, finally, if possible, I was to return home through that part of the District of Keewatin added by the Act of Parliament of Canada of last session to the Province of Ontario, and now known as the District of Patricia, obtaining such general information as to the character, resources and possibilities of this district as it might be possible to procure in the time at my disposal.

In accordance with these instructions, I engaged Professor Lewis B. Stewart, Professor of Surveying and Geodesy in the University of Toronto, as surveyor, and Mr. W. B. McPherson, B.Sc., as assistant surveyor and chainman, and at the same time made arrangements for an assistant geologist to go by ship to Port Nelson in order to accompany me on my journey home through the District of Patricia. I also engaged Mr. Hugh McDiarmid, of Maxville, Ontario, who had already spent some years on Hudson Bay, as chainman and canoeman.

From Selkirk to Norway House.

On the twenty-seventh of May, 1912, accompanied by Messrs. Stewart and McPherson, I left Toronto and proceeded to Nipigon, where, through the kind assistance of Mr. William McKirdy, four good Indian canoemen were secured, and thence the party proceeded to Selkirk, Manitoba. Here it is necessary to wait for a few days, for the steamboats declined to start for the north end of Lake Winnipeg until it was reasonably certain that the ice had disappeared from it. On the fourth of June we took passage on the steamer "Wolverine," belonging to the Northern Fish Company, and started from Selkirk. The boat was loaded with fishermen and their supplies for the summer, and it was necessary for us to stop at several fishing stations on the shore and islands of Lake Winnipeg, on the way north. Nevertheless, we reached Warren's Landing, at the north end of this lake, where the Nelson river flows out of it towards Hudson Bay, on the morning of the sixth of June, and on the afternoon of the same day we continued down the Nelson river to Norway House, where the Hudson's Bay Company has one of its oldest and most important trading posts.

Here it was necessary, if possible, to obtain two more canoemen, for we had three canoes and I needed to have two expert Indian canoemen in each canoe. We had already obtained four such men at Nepigon, but they knew nothing of the waters ahead of them, and I had purposely refrained from engaging more canoemen in Nipigon in order to be able to take two men from Norway House who knew the river from there to York Factory, with its rapids, falls and portages.

Unfortunately others wanted to go to Hudson Bay as well as ourselves. The number of canoemen at Norway House was limited and there was keen competition for them, so that a delay of several days occurred here before men could be obtained. As far as possible the time was employed in correcting instruments and getting everything in order for immediate work when we should reach the field of our proper labours.

Having at length engaged two Indians, we left Norway House on the morning of the twelfth of June in three canoes, with such provisions as would be necessary to supply us for a month, and started northward down the Nelson river to the mouth of the Echimamish, up the Echimamish to its head, across the narrow rocky divide which bounds the waters of the Nelson river on the east, and then down the Hayes river to York Factory, the great historic trading post of the Hudson's Bay Company, built on the west bank of the river near its mouth, making a track-survey of our route, the distances on the rivers and smaller lakes being estimated, while the lengths of the larger lakes were measured with a boat log.

The Shamattawa river flows into the Hayes river sixty miles from where this latter stream empties into Hudson Bay, and as we were to explore a strip fifty miles wide from the shore of the Bay southward, I decided to begin our survey at this point. Professor Stewart therefore began a careful survey of the Hayes river downward from the mouth of the Shamattawa, taking his bearings from the true meridian with a transit, and measuring his distance with a rod and stadia hairs, checked in several places by careful chainage.

At the same time I went up the Shamattawa river for a few days to investigate the character of the country through which it flows.

Our journey from Norway House to the mouth of the Shamattawa, a distance of 260 miles, had been rather slow, as we were constantly delayed by head winds and stormy weather, but on the twenty-seventh of June, Professor Stewart started his survey downwards from that point and continued it from that time until July 12th, when he reached the mouth of Hayes river. During the latter part of the time in which Professor Stewart was so occupied, I was at York Factory and on Nelson river making investigations as to the character of the surrounding country, and also of the country extending eastward, obtaining all the information that it was possible to obtain from the Indians who have their hunting grounds in this latter district.

After Professor Stewart had made survey of the Hayes river from the Shamattawa river to its mouth, he continued it round the point which separates that stream from the Nelson river, up Nelson river to Seal Island and down its west shore to Flamborough Head. As soon as this was completed I chose a frontage of ten miles on the east side of Nelson river, and Professor

*Extracts from 22nd annual report Bureau of Mines, Ontario, 1913. The report contains geological and topographical descriptions of the country explored and is accompanied by a map.

Stewart marked it with proper posts and mounds, which I also signed with him. We then cut lines back through the forest for a distance of a mile at the north end of the ten mile strip, and for five and a half miles at its south end, the eastern portion of this latter line crossing the Hayes river and connecting with the stadia survey which had been made of the banks of this latter stream.

After choosing the frontage for the Province of Ontario on the Nelson river it was necessary, in outlining a strip of land five miles wide from that frontage eastward to the western boundary of Ontario, to find a feasible crossing place for a railway across the Hayes river. On account of the shifting character of the channel of this stream near its mouth, and of the enormous floods and ice-jams to which it is occasionally subjected in the spring, such a crossing place could not be found nearer than thirty-three miles from Hudson Bay, not far from the junction of a tributary called the Pennycutaway river which empties into the Hayes river from the west.

Therefore, as it was necessary to go up the Hayes river at least 33 miles before a crossing for a railway could be found, it was necessary for me to bend the five-mile strip of land southward from the mouth of the Nelson river along the west side of the Hayes river at least as far south as the mouth of the Pennycutaway, and the survey of this strip so chosen was marked by substantial posts at various conspicuous places, as shown on the accompanying map of the lower portions of the Hayes and Nelson rivers.

It was impossible for me to explore the strip of land eastward from the Hayes river to the boundary of the Province of Ontario in the remaining time at my disposal, but I made a trip in a canoe up the Machichi or Fourteen river, which flows northward into Hudson Bay across the country to the east of Hayes river, and obtained a fairly clear idea of the character of the country along its banks.

By the time Professor Stewart had completed the survey of the land chosen for the Province of Ontario in the vicinity of the mouth of the Nelson and Hayes rivers the summer was almost over, and it was necessary for him to return to Toronto to resume his duties at the University, so, accompanied by Messrs. W. B. McPherson and H. McDiarmid and the Indians from Norway House, he returned up the Hayes river to Norway and thence down Lake Winnipeg to Selkirk and home to Toronto.

On the twentieth day of August the steamship "Stanley" arrived at York Factory, bringing Mr. P. E. Hopkins as assistant to accompany me on my journey homeward.

The annual steamer which brings out the supplies for the Hudson's Bay Company at York Factory had not yet arrived, and some lines of supplies, especially bacon and meat, had run short at this central depot. Consequently the Company was prevented from furnishing the usual supply of meat to its trading posts on the Severn River, which I was about to visit. This was particularly unfortunate for us, because the bacon which had been sent to me on the steamer "Beothic" and delivered to me at the mouth of the Nelson River, was almost all decomposed and quite unfit for use when it was delivered. In spite of its bad condition, however, we were obliged to do the best we could with it and to use parts of it.

From York Factory via Severn River.

On the twenty-sixth of August I left York Factory, accompanied by Mr. Hopkins and the four Indian canoemen from Nipigon, with two canoes, and took passage in a small sail-boat of the Hudson's Bay Company along the shores of Hudson Bay to Fort Severn, where we arrived eight days later.

On the 4th of September we started southward from Fort Severn in our two canoes heavily laden with provisions, for it was uncertain when or where we would be able to get any further supplies. We ascended the Severn River, hauling our canoes with lines, a distance of fifty-six miles, to the mouth of the Fawn River, which is a beautiful clear stream 150 yards wide at its mouth, with terraced banks 80 feet in height. Thence we ascended Fawn River, walking on the bank and hauling our canoes as before for a further distance of 180 miles, but through much of this distance the journey was made very laborious by the fact that the weather was rainy and stormy and the river was swift, deep and narrow, and overhung with tall willows, so that our progress was often very slow, the tracking line being constantly entangled in the overhanging willows. Fifteen days were occupied in this journey, and at the end of that time we welcomed the occurrence of heavy rapids, past which it was necessary to carry our canoes and supplies, but between which the water was not so swift as before, and it was possible to make some progress with our paddles.

Trout Lake.

On the twenty-first of September, Trout Lake was reached and we had the pleasure of meeting Mr. H. C. Moir, the gentleman who is in charge of the Hudson's Bay Company's trading post for that company. Here we were able to replenish our supply of flour, but it was impossible to obtain any meat, and our own supply of meat at that time consisted entirely of partly decomposed bacon.

Up to this time we had travelled from Severn House without anyone who had any local knowledge of the country, and guided entirely by the map on the scale of sixteen miles to the inch published by the Geological Survey of Canada. From Trout Lake southward across the height of land to Cat Lake, on the waters of the Albany River, the route travelled by the Indians was not known, and as we wished to follow it, it was advisable, if possible, for me to employ an Indian here to go with us and show us the way by which he was accustomed to travel. The Indian obtained for us by Mr. Moir was a man of considerable intelligence named Adam Thunder, and on the morning of September the twenty-fourth we started across Trout Lake with Adam and his wife and two children in a canoe of their own as guides.

From Trout Lake to Windigo Lake.

From Trout Lake we entered a small stream named Mishwamagan or Red Sucker River, and ascended it southward to its source in several small lakes, from one of which we carried our canoes and contents across to Kwiuswagami Lake and thence into Makoop Lake, which empties by an independent outlet westward into Severn River. Makoop Lake is evidently good fishing ground, and some Indians have here two substantial log houses in which they live in the winter, although they move about from one part of their fishing ground to another in the summer.

From Makoop Lake, instead of turning down stream, we entered Negigamo or Otter River, and ascended it for a day's journey, when though it was still a stream of considerable size, we left it and turned westward across a portage somewhat more than a mile in length to another tributary of Severn River, which, at the

point we reached it, was ninety yards wide with low swampy banks on both sides.

On this river, Adam, our guide, decided to leave his wife and family with some friends or relatives whom he met, and to take a seat in one of our canoes, where he would be more useful to us, both by assisting in paddling, and, being close at hand, he would be able to give us information about the country from time to time as the various features were observed.

This river is also a tributary of the Severn, but Adam said that it had no particular name. I have therefore called it Ningitowa River, taking the name of one of the lakes on its course. We ascended it for three days through many lakes and over numerous portages to a lake with a name too long for intelligent English pronunciation, but it means Big White Fish Lake.

From the south side of this lake is a portage twelve hundred yards in length across a rocky hill to a small stream which in a short distance flows into Weagamow lake, and this lake in its turn discharges by another independent stream westward into Severn river, and is fed by two streams from the east and south, known respectively as the Baribou and Saskatchewawa.

Weagamow lake also seems to be a good fishing ground, for there was a large band of Indians camped near the place where we entered it, engaged in catching a supply of fish to feed them through the autumn and winter.

From Weagamow lake I had hoped that our route was to take us down stream to the Severn river and thence southward up the main river, but in this I was disappointed, for instead of turning down stream we entered Saskatchewawa river and ascended it to a small lake named Augutua lake, from which a number of high sand hills may be seen forming conspicuous features in the landscape.

Windigo Lake.

From the southwest side of this lake we made a portage three and a half miles in length, over one of these sandy hills to Windigo lake, the largest body of water that we had encountered since leaving Trout lake. This, too, is a favorite fishing ground for the Indians, and on its eastern shore they have some small houses around which were gardens, where potatoes had been grown, though at the time of our visit they had been dug and were stored away. Windigo lake also discharges westward into the Severn river by an independent stream, which, however, we were unable to visit, but we were told by Adam that it flowed westward to Niskib or Goose lake, in which it was joined by Weagamow river, and from which the united streams flowed into Severn river. Passing through the lake we ascended a small river for about fifteen miles, when, by a series of long portages, we passed out of it and into the Cedar branch of the Severn river, which we reached at Little Cedar or Geechika lake, the northern limit of growth of cedar trees.

Thus, on leaving Trout lake, we had ascended a small stream to the higher land lying between the watersheds of the Severn and Wenisk rivers, on which are a number of lakes, and we had travelled southward on the western side of the height of land through a chain of lakes, instead of travelling continuously up the main branch of the Severn river. This route leads through small streams and over many long and swampy portages which are often poorly cut out, but the reason why it is used by the Indians instead of the main river doubtless is that it leads through lakes in which fish are abundant, and where game is probably moderately plentiful. Whether it is easier for large canoes to navigate than a route up the main river is uncertain, because the river is as yet largely unexplored.

From Little Cedar Lake we journeyed southward up a small winding stream and over many portages to the height of land dividing Severn from Cat river, which is one of the upper tributaries of Albany river.

Cat Lake.

On the thirteenth of October we paddled up to Hudson's Bay Company's post on Cat lake, and were kindly received by Mr. Lawson, the store-keeper in charge for the Company, and, as he was supplied with provisions for the winter's trade, we were able to get such staples from him as were necessary to carry us through to our destination at Sioux Lookout, on the Grand Trunk Pacific railway. A supply of nice fresh bacon was particularly welcome, as we had become very tired of living on rotten bacon, and besides we had that day eaten the last of both that and our sugar, so that we were quite ready for a new supply.

We were now in the country that had previously been surveyed by explorers from the Geological Survey of Canada, and, as the season was far advanced, we made all haste southward down Cat river to Lake St. Joseph, across a portage to Root river, down Root river to Lac Seul, and thence southward to Sioux Lookout, where we arrived on the evening of the twenty-third of October, seven weeks from the date when we left the mouth of the Severn river. Here our canoes were stored, the men were taken eastward to Nipigon and paid off, and I and my assistant, Mr. Hopkins, returned to Toronto.

Minerals.

No minerals of economic importance have yet been recorded from the vicinity of the route travelled over last summer, but there is little doubt that fuller investigation will determine their existence.

Several areas of greenstone and other similar rocks of Keewatin age were crossed, especially on Trout, Windigo and St. Joseph lakes. Wherever rocks of similar age and character to these have been thoroughly prospected in other parts of Canada, valuable minerals, usually including the precious metals, have been found in them, and there is no reason to suppose that the areas of Keewatin rocks here recorded will form exceptions to this rule. The Paleozoic limestone near the shore of Hudson Bay may also contain beds of salt, gypsum or other valuable minerals of similar character.

TUNGSTEN.

The tungsten bearing mineral scheelite has been found at a number of localities in Canada, but the only place at which it has been worked commercially is at Scheelite Mines, Moose River district, N.S. Here it occurs in quartz veins cutting the quartzites and slates of the gold bearing series. The quartz veins also carry mispickel and several other minerals, but are not gold-bearing. A mill has been erected and about 15 tons of concentrated ore (72 per cent. scheelite) have already been shipped. Scheelite also occurs in the Malaga gold mining district, Halifax County, while at one locality near South East Margaree in Inverness County, C.B., from 300 to 500 pounds of hubernite (Fe, Mn) WO_4, were recovered from a large detached mass of quartz. The mineral has also been noted at New Ross, in Lunenburg County, and at Perry Lake, West Waverley, Halifax County, N.S.

PERSONAL AND GENERAL

Mr. H. Bradley is in Toronto.

Mr. G. M. Colvocoresses is at Humboldt, Ariz.

Mr. R. W. Brock has been appointed Deputy Minister of Mines to succeed Mr. A. P. Low.

Mr. G. G. Gibbins is in British Columbia. His address for several weeks will be 1159 Pendrell Street, Vancouver.

Mr. Harold Whittingham is in Sardinia, with Mr. C. W. Wright.

Dr. Frank Adams has been appointed a member of the Commission on Conservation of Natural Resources.

Mr. Chas. A. Banks, manager of the Jewel-Denero Mines, Ltd., operating near Greenwood, B.C., left that Province recently for New York en route to London, England.

Mr. W. L. Coulson has resigned as general manager for the Canadian Collieries (Dunsmuir), Limited, operating coal mines on Vancouver Island, B.C. Mr. C. F. Compton, assistant secretary, remains in charge of the company's head office in Victoria. Mr. J. R. Lockard, who has been superintendent of the company's Comox colliery, Cumberland, is now general superintendent. It is unlikely another general manager will be appointed for some time, if at all.

Mr. W. B. Dickson, of New York, vice-president of the Hedley Gold Mining Co., was at the company's property in Camp Hedley, Similkameen, B.C., about the middle of December.

Capt. Harry Johns, superintendent for the British Columbia Copper Co., in Kootenay district, has been seriously ill at his home in Nelson. At last accounts his condition had improved.

Mr. Thos. McGuckie has retired from the position of general superintendent for the Western Fuel Co., of San Francisco, California, which has large coal mines near Nanaimo, Vancouver Island, B.C.

Mr. Donald G. Forbes, of Victoria, has gone to England for the winter. During the past field season he had been investigating mining conditions in a number of mining camps in the Coast district of British Columbia, to report on same to the Provincial Department of Mines.

Mr. E. Jacobs has returned to Victoria, B.C., from a month's trip to interior mining camps, including Boundary, Rossland, Slocan, and a short visit to the Coeur d'Alene district of Idaho.

Lieut.-Col. R. G. Edwards Leckie has returned to Vancouver, B.C., from a somewhat lengthy visit to Great Britain.

Dr. E. B. Milward, who for about a year had been developing a mining property near the east shore of Kootenay lake, British Columbia, resigned his appointment as manager some time ago and is now at Ainsworth.

Mr. D. H. Nellis, of Woodberry Creek camp, in Ainsworth mining division, was in Victoria lately.

Mr. M. E. Purcell, of Rossland, B.C., superintendent of the Consolidated Mining and Smelting Co.'s Centre Star-War Eagle group of mines, has been nominated for election as a councillor of the Canadian Mining Institute. Mr. W. J. Sutton, of Victoria, a well-known geologist who is now chairman of the Western Branch of the Institute, has been nominated for election as a vice-president. These nominations have been made to fill vacancies that will be caused by the retirement next March of Mr. R. H. Stewart, of Trail, vice-president, and Mr. Robert R. Hedley, of Vancouver, councillor.

Mr. Hermann C. Bellinger has resigned as general manager for Great Cobar, Ltd., which company has large copper mines and smeltery in New South Wales, Australia. Mr. Bellinger was for years connected with copper smelting works in British Columbia—at Trail in the nineties, and several years afterward at Crofton, Vancouver Island.

Mr. R. Randolph Bruce, of Wilmer, East Kootenay, B.C., is in England, where he was married on January 6. He was manager of the Paradise mine, in Windermere mining division, East Kootenay, when that property was operated some time ago.

Mr. E. J. Conway has been transferred by the Granby Consolidated Co. from a lime property on Portland canal, B.C., on which it is doing preliminary work in case it shall require to use lime flux at its new smelting works, Anyox, Observatory inlet, to the Copper Queen mine, on Texada island, where he has charge of the development work lately undertaken by the company under its option of purchase.

Mr. W. D. L. Hardie, formerly colliery manager at the Galt coal mines, near Lethbridge, Alberta, and since then manager of the Diamond City coal mine, ten miles from Lethbridge, has been appointed mayor and commissioner of finance and safety for the City of Lethbridge, which, as from January 1, adopted the commission form of municipal government. There are three commissioners, with Mr. Hardie at their head.

Mr. G. P. Jones, general superintendent for the Hedley Gold Mining Co., operating the Nickel Plate group of gold mines and 40-stamp mill in Hedley camp, Similkameen, B.C., has returned to Hedley from a business visit to the company's head office, New York, and thence to Los Angeles, California.

Mr. F. S. Norcross, superintendent of the British Columbia Copper Co.'s mines in Boundary district, B.C., has gone on a month's vacation trip to Michigan.

Mr. M. K. Rodgers has returned from Hedley, B.C., to his home in Los Angeles, California, after having been in consultation with some of the officials of the Hedley Gold Mining Co., relative to a new hydro-electric power station and plant, the construction of which on Similkameen river has been commenced, and for which work the directors of the company have authorized an expenditure of $200,000.

Mr. R. H. Stewart, general manager for the Consolidated Mining and Smelting Company of Canada, Ltd., has returned to British Columbia from Toronto, where, on December 16, he attended the company's eighth general meeting of shareholders.

Mr. Francis A. Thomson, head of the mining engineering department of the State College of Washington, Pullman, Washington, has been elected chairman of the Columbia (formerly the Spokane) local section of the American Institute of Mining Engineers. Professor Thomson is well known in both eastern Washington and in mining districts in British Columbia.

Mr. John Vallance, until last spring superintendent of the Standard silver-lead mine, near Silverton, Slocan lake, B.C., is now at Twodot, Montana, where he has joined one of his sons in a mercantile business.

Mr. Roscoe Wheeler, superintendent of the Hedley Gold Mining Co.'s stamp mill and cyanide plant at Hedley, B.C., has been in California on a holiday vacation.

Mr. D. J. Williams, formerly assistant superintendent for the Pittsmont Copper Co., of Butte, Montana, in November, went to the Rocher Deboule mine, in Hazelton district, Omineca mining division of British Columbia, to take charge of development and construction work the Continental Development Co., of Butte, planned to do under a lease it had of the upper workings of the Rocher Deboule mine, which is still only in an early stage of development. Progress has been hindered, though, by a minority of the shareholders of the Rocher Deboule Co. applying to the British Columbia courts to protect them from what they claim is an arrangement detrimental to their interests.

The Geological Survey has issued a new geological map of Alberta, Saskatchewan and Manitoba.

A meeting of the Toronto branch of the Canadian Mining Institute was held on Saturday January 10 at the Engineer's Club.

Mr. G. G. S. Lindsey has been nominated for the presidency of the Canadian Mining Institute. Mr. Chas. Fergie, of Montreal, and Mr. W. J. Sutton have been nominated as vice-presidents, and Messrs. John Hardman, J. W. Pyke, W. S. Johnson, J. J. Penhale, M. E. Purcell, G. C. Bateman, and C. E. Smith as councillors.

The 107th meeting of the American Institute of Mining Engineers will be held at 29 West 39th Street, New York City, February 17 to 20, 1914.

Mr. R. E. Hore has returned to Toronto after a visit to the Michigan copper mining district.

The annual meeting of the shareholders of the Porcupine Crown Mines, Ltd., will be held in Montreal on January 28, 1914.

The 16th annual meeting of the Canadian Mining Institute will be held in Montreal, March 4-6, 1914.

Mr. Siegfried Meyer, representing Beer, Sondheimer & Co., recently visited the Cobalt district.

Mr. Chas. Fergie, of Montreal, who recently joined the directorate of the International Coal Mining Co., Ltd., has been appointed president and managing director of the company, as from the first of this year.

HOLLINGER.

Gross profits for the period of four weeks ending December 2, 1913, amounted to $118,090.74. The mill ran 96 per cent. of the possible running time, treating 13,140 tons, of which 383 tons were treated for the Acme Gold Mines Limited. The average value of Hollinger ore treated was $15.17 per ton; approximate extraction 96.16 per cent.; milling cost $1.402 per ton.

Work in the mine continues to yield satisfactory developments. By means of diamond drilling an extension of No. 1 vein to the south upon the 200 feet level was picked up, and subsequent work is proving this to be a very valuable extension. By means of diamond drilling it has been shown that No. 2 vein extends over 200 feet beyond its known limit upon the 100 feet level. By means of crosscutting, No. 2 vein has been picked up upon the 425 feet level. No. 6 vein upon the 100 feet level and No. 5 vein upon the 200 feet level, have also been reached by crosscuts, the latter vein showing a width of 22 feet and carrying $12.27 per ton where cut. No. 7 winze, which is being sunk below the 425 feet level upon No. 1 vein, had reached a depth of 68 feet below the level on December 2nd, the vein continuing at about 8 feet in width.

CANADIAN MINING INSTITUTE—WESTERN BRANCH.

A meeting under the auspices of the Western Branch of the Canadian Mining Institute was held at Sandon, Slocan, B.C., on December 10, ulto. In the unavoidable absence of the chairman of the branch, Mr. W. J. Sutton, of Victoria, Mr. Oscar V. White, superintendent of the Slocan Star mines, presided.

A review of mining in Slocan district was submitted by the secretary of branch, Mr. E. Jacobs, who, after noting the much improved position of mining throughout that part of West Kootenay, and giving a list of properties on which mining was being, or had been, done during 1913, called attention to the fact that the gross value of the mineral production of Slocan, including about $5,000,000 from Ainsworth mining division, usually included when speaking of Slocan district, had been to date approximately $32,000,000. For the year 1913, he estimated a total which would prove the highest in 15 years—since 1898, when it was $2,620,000.

Mr. G. C. Mackenzie, chief of the metallurgical division of the Mines Branch, Canada Department of Mines, Ottawa, who has charge of the experiments in electric smelting of lead-zinc ores at Nelson, undertaken by the Mines Branch, gave the meeting particulars of the plant and operations of the Dominion of Canada ore-dressing laboratory at Ottawa, and the conditions under which tests of ores will be made for miners, prospectors, and others. Many questions were answered during half an hour's conversational discussion that ensued.

Afterward, in connection with the subject of "Electric Smelting of Lead-Zinc Ores," the secretary gave an abstract of a paper presented by Prof. R. S. McCaffery, of the University of Idaho, at a meeting of two local sections of the American Institute of Mining Engineers recently held at Wallace, Idaho. This led to a discussion, in the course of which Mr. Mackenzie gave much information concerning what was being done in various countries and the progress made, but was not at liberty to say anything about the work he will do at Nelson, leaving that until results shall be available to make public. A vote of thanks to Dr. Haanel, Director of Mines, for authorizing Mr. Mackenzie to attend the meeting, was passed.

Mr. Wm. Thomlinson, of New Denver, read some notes on uncommon minerals occurring in Ainsworth and Slocan divisions, and others supplemented his paper with information of minerals that had come under their notice. The Provincial Mineralogist of British Columbia was thanked for having employed Mr. Thomlinson to collect samples of the district ores, a very fine collection of which had been got together and sent to the Mines Department, Victoria.

A press despatch from Washington, D.C., gives the total value of the mineral production of Alaska for 1913 as $18,900,000, against $22,537,831 for 1912. The U.S. Geological Survey estimate is that $15,000,000 of the 1913 total represents the value of the gold produced, two-thirds of which was from placer mines. The dry summer and the working out of old bonanzas, together account for a decrease in placer gold production and correspondingly in the total of mineral production for the year.

SPECIAL CORRESPONDENCE

COBALT, GOWGANDA AND ELK LAKE

Cobalt Mining Companies Had a Successful Year, Paid $10,271,694 in Dividends.—The year 1913 will undoubtedly stand as a record for dividends paid from Cobalt mines. The production will be slightly more than in 1912, but considerably less than in 1911, the value in dollars will be higher than in 1911, but less than in 1912. The decrease in dollars is due to the fact that there has been a drop of an average for the year of one cent an ounce.

The production is estimated as being 30,600,000 oz. of a value of $17,600,000, as compared with a value of $17,671,000 in 1912. The figures are based on actual production for eleven months and estimated production for the twelfth.

The dividends are more than a million dollars in advance of the previous year. This is due, no doubt, to the fact that as the result of high production and high price of silver in the closing months of 1912 some remarkable dividends were paid in the first months of 1913. These dividends were, of course, earned in the previous year.

The total dividends paid by the Cobalt mining companies during 1913 amounted to $10,271,694, which figure does not include the Casey Cobalt or the close corporation. Dividends from the inception of the camp amount to $46,933,818. Returns from close corporations would bring the figures to $51,638,681. Dividends from the mines in 1912 showed a total of $9,324,044, giving an increase of nearly one million dollars for the year which has just closed. Three new names appear on the dividend paying list for 1913, bringing the total to 22 dividend payers, both past and present, of which 17 made returns to shareholders during the year. The new names on the list are Seneca-Superior, Cobalt Lake, Caribou Cobalt, and Casey Cobalt. Nipissing, with the continuance of the 30 per cent. rate, paid $1,800,000, the highest single disbursement by any one mine; the Coniagas, with the help of a big bonus, coming second. Of the total disbursements from the camp the Nipissing has paid back to shareholders more than the entire dividends of the camp during the record year. The list shows eight companies which have redeemed their capitalization, and it is only reasonable to believe that during 1914 this list will be further augmented.

The Beaver Auxiliary is still short of water and development operations have been much interrupted. The damming of the small lake was undertaken late in the spring and not enough water was impounded to carry on work. Therefore it is likely that development may be held up for some time yet.

Walsh.—While drifting on a calcite vein on the Walsh prospect at Gowganda some high grade was struck. The ore has a width of 4 inch. and drifting is now going on, to determine the length of the shoot.

La Rose.—The position of La Rose at the end of the calendar year was as follows:

Tons produced	3,342
Gross ounces produced	2,623,000
Gross value	$1,559,000
Net profit	9161,000

The production does not show as much of a decrease as the net profit. This is probably due to the fact that the La Rose is now carrying on a great deal of dead work at the La Rose proper, the Lawson and the Fisher-Eplett, and it raises the cost per ounce very materially.

Trethewey.—The production for the Trethewey mine for the month of November was 52,500 oz., about the same amount as produced in the previous month. The mill treated 3,100 tons with an assay head of 21 oz. The total production of the Trethewey for the year has shown only a slight falling off in comparison with the previous twelvemonth.

Coniagas.—In its usual frank and business-like statement the Coniagas Mining Co. shows that there has been but a small reduction of ore reserves, while a production of 3,572,398 oz. was obtained. Ore reserves are now estimated at 13,339,000 oz. This is tantamount to saying that the present year's production has been obtained at the expense of a decrease of 600,000 oz. in ore reserve, President R. W. Leonard, in his address, noted that dividends paid to October 31, made a total of $5,360,000. The report shows that the ore is mined and concentrated at a net cost of 8.776 cents per oz., as compared with 8.515 cents per oz. in 1912. The cost includes head office expenses, royalties and all expense exclusive of shipping, smelting, mining and marketing the ore. The average price received per oz. was 60.55 cents.

The total production of the mine since 1905 when the first ore was shipped amounts to 17,662,904 oz., showing an increase in every year save two.

Mr. R. P. Rogers, assistant to the general manager, states that the concentrating mill was operated for 98 per cent. of the possible time. The total tonnage of ore milled was 54,890, as compared with 53,627 tons.

Development of new ore bodies during the year is estimated at 2,950,000 oz., the shipments being 3,572,398 oz.

Draining Cobalt Lake.—Since Mr. Godson, the Mining Commissioner, issued his order permitting of the draining of Cobalt Lake, the company has lost no time in getting to work. A gang of men have been set to work cleaning out the creek, which is the natural outlet of Cobalt lake. This preliminary work of clearing out and widening the channel of the creek will lower the lake six and a half feet. This work is necessary in order to give ample flow for the town sewer and the flume which will carry off the waste water from the mills. This has to be completed before pumping commences. The specifications for the pumps are now out. Plans for the dam across Short lake have been drawn and work there will commence at once, too.

Mr. M. B. R. Gordon, the mine manager, hopes that the lake will be drained of water by the middle or end of October.

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

The Clark property at the Harricanaw river in Northern Quebec, is exciting much attention. The representative of the International Exploration Company, which holds this property, describes the vein as being 8 to 10 inches wide on the surface. At six feet in depth the quartz is three to five inches in width. There was also five feet of schist. Values in the quartz are cited as being $104 to the ton and $26 in the schist. Fifteen men are now at work on the property, but this force will be increased almost at once. A shaft will be sunk to the 100-ft. level at once.

La Mine d'Or Huronia.—Three gold bars have been shipped from La Mine d'Or Huronia in Gauthier township. These bars are stated to be worth $3,375. This represents a run of 400 tons taken from one of the principal veins of the property. This ore was treated in the small mill between November 9 and December 13. It was taken off the plates alone, the concentrates not being available. Owing to the fact that the only power available is a 30 h.p. boiler and engine, it was never possible to run the little mill more than a third of its capacity, and development has been very slow for the same reason. To get more power it has been decided to develop at Victoria Creek Falls. This is only 4,000 feet from the mine. At a recent directors' meeting at Three Rivers it was decided to close down the mill and put all hands to work on the power scheme. It is then hoped to raise the crushing capacity of the mill to 100 tons per day, and also have enough power to run drills on development. The management hope to have their mill running at capacity about April the first. So far all the ore mined has come from an open cut 25 ft. deep by 30 ft. long, averaging between the walls about 6 ft. There is a considerable quantity of copper in the ore.

Dome Lake.—Active mining operations will be resumed at the Dome Lake within a few weeks. The main shaft, which is now 250 ft. down, will be continued to the 400-ft. level where development will commence. From the 180-ft. level a crosscut will head for the No. 1 vein and a raise will be put up on the ore body. A general overhauling is being given to the plant at the property. Two motors and transformers have been ordered. Before starting the mill again it is the intention of the Timiskaming and Hudson Bay to develop more ore at the lower levels. Undoubtedly changes will be made in the flow sheet of the mill, though exactly what those changes will be, has not yet been determined.

Hollinger.—For the four weekly periods ending December 2, the gross profits of the Hollinger mines amounted to $118,090. The net surplus now amounts to $785,665. As to development, Mr. P. A. Robbins reports that several extensions of ore bodies have been cut. The mill ran 96 per cent. of the possible running time, treating 13,140 tons, of which 383 tons were treated for Acme Gold Mines, Limited. The average value of Hollinger ore was $15.17 per ton, approximate extraction 96.16 per cent., milling cost $1.402 per ton. By means of diamond drilling an extension of No. 1 vein to the south upon the 200-ft. level was found, and subsequent work is proving this to be a very valuable extension. By means of diamond drilling it has been shown that No. 2 vein extends over 200 ft, beyond its known limits upon the 100-ft. level. By means of crosscutting, No. 2 vein has been picked up upon the 425-ft. level, No. 6 vein upon the 100-ft. level and No. 4 vein upon the 200-ft. level have also been reached by crosscuts, the latter vein showing a width of 22 ft. and carrying $12.27 per ton where cut. No. 7 winze, which is being sunk below the 425-ft. level upon No. 1 vein, has reached a depth of 58 ft. below the level early in December. The vein continues about 8 ft. in width.

McIntyre.—The November report of the McIntyre shows a total production of $30,278. The ore milled averaged $7.6363 per ton, and costs $6.24 a ton, so that a profit of $1.3963 per ton was realized. Costs are down almost a dollar a ton in comparison with October, but the grade of ore has dropped also. Ore milled amounted to 3.965 tons. An extraction of 94.3 per cent. was obtained. Operating costs per ton milled were divided as follows: General charge .659; mining, $2.175; mine development, $1,716; milling, $1.69. Total cost per ton, $6.24.

Tough-Oakes.—While driving into the foot wall to make the sump at the 200-ft. level of the Tough-Oakes mine of Kirkland lake, a new extension of the vein has been located. It shows a high grade body 18 inch. wide, which runs 65.68 oz. of gold at the point where opened up. At a distance of 20 ft. east of the shaft a crosscut was started and in 8 ft. the extension was encountered. No work had previously been done in the hanging wall and the discovery was quite unexpected. In the west drift 60 ft. from the shaft the vein is 10 in. wide, 4 in. of which ran 57.2 oz., while 6 in. ran 11.64 oz., and, in addition, there are 4 ft. of $15.20 ore.

QUEBEC

The winter season is in full swing, and coupled with a rapid succession of national and ecclesiastical holidays, gives rather the air of a south German carnival than the diligent hum of a successful mining industry. Despite all this, however, the buoyant tone of the asbestos markets is causing the mine managers to force the production as much as these circumstances will allow.

The Asbestos Corporation has been operating consistently and vigorously. The chief quarry, the King mine, has been giving some very substantial results, though somewhat impeded by the necessity of carrying on considerable development work. Their other important properties, the Beaver, and the British Canadian, have been prospering and shipments from all points are well in advance of last year.

The Jacobs Mining Co. has been pushing operations as much as possible. The newly inaugurated aerial tramway has been giving much trouble and causing a banking up of sand dumps in the vicinity of their mills. This system, while admirable in mountainous sections and where transmission period leaves ample time for repairs, does not appear to advantage where a twenty-two-hour service is required. The fact that it is not how much, but how little, machinery can be employed is fast becoming axiomatic in asbestos.

Martin Bennet.—The recently opened Martin-Bennet mines have been handicapped by the amount of development necessary for the proper opening up of the property. They have recently suspended night milling operations and are devoting the whole force of the night crew to removing barren ground.

The B. & A. at Robertson has been the only working representative for the past two years of the East Broughton-Robertson group of mines. This company has thereby gained no small advantage and the directors hope to report a comfortable balance at the end of the business year. Strenuous efforts have been employed to form a syndicate with the Ling, Frontenac, E. T. and Quebec asbestos companies in East Broughton, but the public are not far enough removed from the scandalous inflations of 1909 and 1910 to render such organization favorable.

The Robertson and Berlin asbestos companies at Robertson have been reported sold, but the truth of the statement lacks confirmation.

The labor market was satisfactory during the past season. An increasingly large foreign population augments the "habitant" class of laborers. Wages have rapidly advanced. Twenty cents an hour is the general

rule, while the large force engaged under the new system of contract work receive from twenty to thirty-five cents an hour.

Power.—There is at present a strong tendency on the part of the mine managers to revert to steam power for operating purposes. The field is practically held by one power company and it is claimed that the prices for power are too high. Ideally electricity has a large advantage over steam, but when the amount of lost time is deducted, it is claimed that steam is cheaper. A much cheaper rate for electrical power is predicted.

BRITISH COLUMBIA

The publication of estimates of the value of the mineral production of the Province in 1913 has redirected attention to the considerable importance of the mining industry. The "Daily Colonist" of Victoria on January 1 printed a statement obtained from the Provincial Mineralogist, in part, as follows: "The value of the mineral production for last year will be approximately $29,550,000, which is nearly $2,900,000 less than that for the year 1912. This decrease is due to a shortage of about $1,600,000 in the value of the coal produced, occasioned by labor troubles on Vancouver island, and a shortage in the production of metalliferous mines due chiefly to a decrease of about $1,160,000 in the value of the copper output and $25,000 in that of zinc, which decreases are, however, partly compensated for by increases in the output of gold, silver, and lead. A portion of the metalliferous deficit is due to a fall in the market price of metals." It is noteworthy that the estimate of the Canadian Mining Journal's correspondent, mailed two weeks before the official estimate was made public, gave the total value as nearly $30,000,000 and the decrease as $2,440,000.

WEST KOOTENAY.

Slocan.—At the annual meeting of shareholders in the Slocan Star Mines, Ltd., held in Vancouver on December 19, the report of the directors and financial statement were adopted. The directors were re-elected, with the exception of Mr. Byron N. White, who declined re-election on account of ill-health. The company's superintendent, Mr. Oscar V. White, was elected in his stead.

The work of driving a long cross-cut adit at a lower level than any of the existing workings of the Noble Five Group, near Cody, has been commenced. It is intended to continue this work throughout the winter. Meanwhile work at other parts of the group has been suspended for the winter and early spring months.

The Van-Roi Mining Co., Ltd., has sent out from its office in London,England , the following report for the month of November received from the managers of its Van-Roi and concentrating mill, situated on Four-mile creek, about five miles from Silverton: Total amount of average assay, silver, 12.5 oz. to the ton, lead 2.4 per ore crushed at mill during run of 305 hours, 1,846 tons; cent., and zinc 8.2 per cent. This yielded 63 tons of siver-lead concentrate and 126 tons of silver-zinc concentrate; the average assay of the lead concentrate was silver 195.4 oz. to the ton, lead 56.3 per cent., and zinc 13.1 per cent., and of the zinc concentrate, silver 42.8 oz. to the ton, lead 0.8 per cent., and zinc 42.8 per cent. The total approximate value of the mill products was $10,108, the estimated expenditure for the corresponding period was: On development, $803; on ore-production, $4,150; on milling, $1,842; total $6,805. The development work done was as follows: Hanging-wall drift, level 9, main vein; situation about 200 ft. west of stope 1; advance 33 ft. and 33 ft. of parallel driving. In 960 drift, level 9; position 960 ft. from mouth of tunnel, into hanging wall; advance 28 ft. In 960 raise, level 9; position 960 ft. from mouth of tunnel; advance 15 ft.

Rossland—The Rossland-Kootenay Mining Co., Ltd., at its ninth annual meeting of shareholders in London on November 25th, discussed the recommendation of the chairman of the board of directors that the reopening of the company's Nickel Plate mine at Rossland be provided for. In order to provide $10,000 to $20,000 for this purpose either some form of reconstruction of the company or levying a call of two shillings a share was suggested. The company's consulting engineer, Mr. Bedford McNeil, who visited Rossland last August, spoke in favour of the chairman's recommendation, and a report by Messrs. Alex. Hill & Stewart also encouraged action.

The Richmond Consolidated Co. reports having cut a good-sized body of ore on the 200-ft. level of its Lily May mine, in the south belt of Rossland camp. The mine is equipped with a small but sufficient power plant, so that if later development prove the occurrence there of any considerable quantity of ore of shipping grade, it should be practicable to make production to an extent that would demonstrate that the property has commercial value, which has not yet been done. The chief obstacle to progress in the south belt is that no financially strong operator, whether individual or company, has given that part of the camp active attention in late years. The Blue Bird, also situated in the south belt, is inoperative notwithstanding that a promising orebody has been opened at a depth of between 200 and 300 ft., the owners being without funds for necessary development work to allow of ore production.

The Le Roi No. 2, Ltd, has sent out from its office in London, England, the following report for the month of November, received from the managers of its Josie group of mines, Rossland: Shipped, 1,800 tons of ore and 145 tons of concentrate. Receipts from the smelter were $33,615 in payment for 2,097 tons of ore shipped, and $2,043 for 142 tons of concentrate; in all, $35,658. Estimated costs for corresponding period were: Development, $8,000; ore-production, $10,000; milling, $1,300. Total, $19,300. Development was as follows: Poorman drift, 900-ft. level; advance 65 ft., of which 25 ft. average gold 4 dwt. to the ton, and copper 0.75 per cent. across 19 inches. Hamilton drift 900-ft. level; advance 110 ft., of which 110 ft. averaged gold 5 grains to the ton, and copper 0.5625 per cent. across 23 inches. No. 9 intermediate drift, 900-ft. level; advance 24 ft., of which 14 ft. averaged gold 7 dwt. to the ton, and copper 10.25 per cent. over 22 inches. South Rodney winze, 1,650-ft. level; advance 17 ft. along which length the average was gold 4 dwt., 4 grains to the ton, and copper 1.625 per cent. across 84 inches.

BOUNDARY.

Grand Forks.—The Granby Consolidated Co. during 1913 smelted more than 1,200,000 tons of ore from its mines at Phoenix. The copper recovered from this ore was between 21,000,000 and 22,000,000 pounds.

Phoenix.—The output of ore from the New Dominion Copper Company's Rawhide mine in 1913, was about 238,000 tons, which ore was smelted at the British Columbia Copper Company's works at Greenwood.

The Consolidated Mining & Smelting Company, during 1913, shipped to Trail, from its No. 7 mine, situated a few miles south of Phoenix, about 4,500 tons of silver-gold ore. Operations at that mine were carried on during only a part of the year, at a time when siliceous ore was required at the company's smelting works.

Greenwood.—The total quantity of ore treated at the British Columbia Copper Company's smelting works here, in 1913, was approximately 622,000 tons, that total including an estimated quantity for the month of December. Rather more than 362,000 tons was from the company's own mines, namely, 304,000 from the Mother Lode mine, near Greenwood; 30,000 tons from the Napoleon mine, in the neighboring State of Washington; and nearly 28,000 tons from the Queen Victoria mine, near Nelson. About 238,000 tons was from the Rawhide mine near Phoenix.

SIMILKAMEEN.

Hedley.—The Hedley Gold Mining Co, crushed nearly 71,000 tons of ore from the Nickel Plate group of mines at its 40-stamp mill, Hedley, during 1913. The assay value of the gold content of that ore was about $852,260, while the recovery was $792,330. There was spent on new construction $5,570. The directors have appropriated $200,000, to be expended on construction and equipment of the new hydro-electric power system and plant, now being put in on Similkameen river, near Hedley.

Princeton.—Development work is being continued on Copper mountain by the British Columbia Copper Company. Reports as to results are favorable, and it is thought there is not now much room for doubt that the company will complete the purchase of the large group of claims on which they have been working for two years or more.

ROSSLAND.

It is reported that the Richmond Consolidated Mining Company has made an important find of copper ore on the 200-ft. level of its Lily May claim, in the south belt of Rossland camp. Some time ago the company acquired this property, which is the oldest location in the camp, and added it to its Richmond group. A power plant was put in and development work commenced from the 200-ft. level of the Lily May, which is reached by an incline shaft put down years ago. If the reported find prove as valuable as claimed, it will be of much importance to the south belt, interest in which has not been active of late, save that the Richmond Company has continued development work ever since installation of its power plant last summer.

PORTLAND CANAL DIVISION.

The Portland Canal Miner says:—With the advent of winter development on most of the mining properties in the Portland Canal mining division is necessarily suspended, and for the next few months it will hardly be likely that development will be continued at more than three of four mines in the division. For several reasons, principally financial, there have not been as many properties worked this year as in 1912, but those on which money has been expended have more than justified the outlay on them. The number of assessments done was quite satisfactory, and proved beyond measure that owners have faith in the future of the camp, and there is reason to believe that next year, when the Granby Consolidated Company's smelting works shall be in operation, work will be resumed on several properties now dormant, so as to permit of shipments of ore being made from them. The fact that the Granby Consolidated Company purposes going into the custom ore smelting business, and will eventually put in a lead stack, should give much encouragement to local mine owners desirous of shipping, but whose ore will not stand the larger expense of shipment to southern smelters. The important work being done by the Portland Canal Tunnels, Limited, in driving the long adit to crosscut the Glacier Creek vein series at depth; the development work being carried on by the Indian Mines, Limited, in the Salmon river district; the opening of the lime deposits at Swamp Point by the Granby Consolidated Company; and the efforts made by many individual prospectors and companies to demonstrate the value of their respective properties, together, speak hopefully for the future of mining in this part of British Columbia. "The Miner" voices the opinion of those most competent to judge that with the advent of capital, Portland Canal mining division will yet rank as one of the largest producers of ore in northern British Columbia.

YUKON TERRITORY.

Dawson.—Travel from Dawson to the Shushanna gold field, Chisana river district, by way of the White River valley, has commenced with dogs and horses. The Dominion Government is constructing a trail, and is otherwise improving traveling conditions by this route to the upper White River section. The Geological Survey of Canada, will make a topographical survey of the whole valley of the White river. Roadhouses are now established at distances of about half a day's travel all along the Dawson-Shushanna route. Heavy stocks of supplies are to be sent in from Dawson as soon as the ice is thick enough for teams to haul them over it.

Whitehorse.—Ore is being shipped daily in considerable quantity from the Pueblo copper mine, by the New Atlas Mining Company, of which Mr. Wilbur D. Greenough is manager. Indications were that the total output for November would be larger than for other recent months. It is stated the company will do development work on the property throughout the winter, and will, as well, prospect other claims in Whitehorse copper camp.

COBALT ORE SHIPMENTS.

The ore shipments from the Cobalt camp for the week ending January 9th were:

	High.	Low	Pounds.
McKinley-Darragh	77,990	.....	77,990
Hudson Bay	86,610	.....	86,610
Penn.-Can.	53,790	.....	53,790
Trethewey	50,180	42,410	92,590
Townsite	138,370	.....	138,370
Beaver	63,870	.....	63,878
Coniagas	45,250	.....	45,250
La Rose	.....	80,000	80,000
Dominion Deduction	78,850	.....	78,850
Crown Reserve	64,170	.....	64,170
	559,080	122,410	781,490

The bullion shipments for the week ending January 9 were:

	Bars.	Ounces.	Value.
Nipissing	169	196,404.71	$112,932.66

This is also the first and only shipment of bullion in the new year up to yesterday.

KRUPP CRUOSONWERK ORE TESTING PLANT, MAGDEBURG, GERMANY.

Ore dressing generally involves two distinct processes: preparatory crushing of the ore and subsequent separation of the various components of the disintegrated material. Owing to the great variety, both of the physical qualities and the chemieal composition of ores, a great number of possibilities of treatment offer themselves in crushing and still more so in the concentration of ores. In many cases it is not easy to decide which of these possible ways is the most profitable one for the treatment of the ore. For the miner himself it would hardly be possible and certainly not advisable to erect an experimental plant of his own; this would be a costly and inadequate undertaking.

Owing to this fact and in order to assist the Canadian mining industry, the Canadian Department of Mines has of late a Central Testing Station in full operation at Ottawa. This testing station has been laid out in such a way that it allows of making all kinds of tests with ore, which is found within the boundaries of the Dominion. The station will no doubt help a great deal in the development of the rich mineral resources of Canada.

In connection herewith it may be interesting to the Canadian mining companies and owners of mining properties to learn that the Krupp Engineering Works maintain a similar full-sized ore-testing station at their branch works in Magdeburg, Germany.

This testing station has been in full operation for more than 15 years, and is equipped with the most up-to-date machinery applied for ore dressing.

The more important machines in this plant, all of full size, are the following:

Ore crushers, slow and high speed roller mills, dry and wet grinding ball mills, Chilian mills, dry and wet grinding tube mills, several other systems of grinding machines, revolving and shaking screens, hydraulic classifiers, coarse and fine jigs, concentrating tables, round buddles, a light 3-head stamp battery and a heavy 5-head stamp battery (either of which may be used with or without different amalgamating tables), washing trommels, pumps, tanks, elevators, roasting and distilling furnaces, etc., etc.

A separate department of this large testing station is exclusively devoted to electromagnetic separation with various machines for treating any kind of strongly or feebly magnetic ores and minerals by means of the dry or wet process.

As regards the size of pieces which are fed into the separators, these may vary according to their magnetic and other special characteristics, between about 2½ inches across down to 250 mesh.

The Mitterberg (Austria) Copper Concentrating Plant. Ullrich Magnetic Separators Eliminate the Ferrous Ingredients of the Middlings. The Whole of the Installation, Mechanical and Magnetic was Supplied by the Krupp Works, of Magdeburg.

To the ore testing station is attached a special chemical laboratory.

With this plant the Krupp Works are in a position to make any kind of test on a full working scale. The engineers and metallurgists, under whose supervision all tests are carried out, are specially trained men, who by their practice have acquired an intimate knowledge of most of the mining camps of the world and thus have thorough experience of the conditions prevailing there.

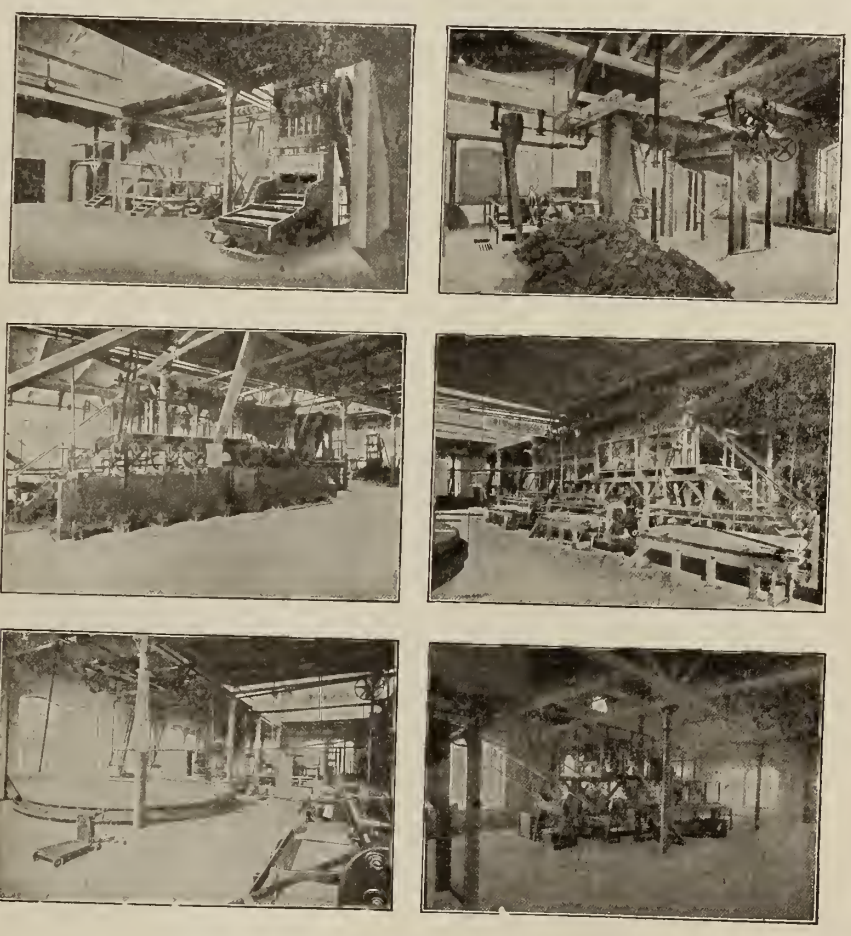
The tests already made on ores from all parts of the world amount to over 2,500 and many a difficult problem has been solved.

The expenses of maintaining an establishment like this are naturally very high. Nevertheless the Krupp

Works do all this experimental work for any mining company at a very moderate and nominal fee. The reports at the same time are very exhaustive and to the mining public of great assistance in the selection of the right plant for the most profitable treatment of their particular ore.

Such reports save the investor a great deal of time and money and show him clearly what can be done with his ore and whether it will be possible to work his property at a profit.

As a rule it is advisable to first submit to the Krupp Works a 10 to 15 lbs. sample for preliminary inspection. If the results with this sample are encouraging, the works will ask to submit 3-5 tons of average crude ore, unbroken for a thorough and exhaustive test.



Krupp Ore Testing Plant at Magdeburg

The reports are forwarded, and, if desired, with samples of the concentrates, etc., without any restriction and the customer is at liberty to buy the machinery wherever he pleases. Naturally the Krupp Works desire a chance of competing with the other makers of ore dressing and metallurgical machinery once it is decided to erect a plant, but no obligation exists in this direction.

Thus it will be seen that Krupp's Ore Testing Plant offers many advantages to the mining public, which should be made use of, whenever the opportunity arises.

Messrs. Jas. W. Pyke & Co., Limited, 232 St. James Street, Montreal, are the Canadian representatives for the Krupp Engineering Works and will be glad to give any further information to interested parties who may wish to send samples of ore over to the Krupp Testing Station for examination.

PETROLEUM.

At the present time the principal oil fields in Canada are situated in the peninsula of Southwestern Ontario, between Lake Huron and Lake Erie. The first oil was found in Lambton County in 1862, and active production has been continued ever since. Until 1907 the Lambton County fields, in which there have been about 11,000 producing wells, were by far the largest producers; since then several new districts have been opened up, the most prominent ones being the Tilbury district in Kent County and the Onondaga district in Brant County. The oil districts are all situated within an area underlain by Devonian strata, usually on an anticlinal axis, and the petroleum is largely obtained from horizons in the Onondaga formation at depths varying in the different localities. When the wells are first drilled, the natural pressure is usually sufficient to force the crude oil to the surface, sometimes producing what are known as gushers. After the flowing period, the oil has to be pumped. While some of the smaller districts became exhausted in a few years, many of the pools being only a few hundred feet wide and perhaps a quarter of a mile long, others have continued to furnish oil for a long period.

Four refining companies are operating in Canada distilling about 10 million gallons of Canadian crude oil per year, but the greater part being distilled at these refineries is still being imported from the United States. The total production for Canada for the year 1912 was 243,336 barrels, valued at $345,050.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.

Jan. 8, 1913.

New York Curb.

	Bid.	Ask.
Alaska Gold	21.25	21.62
British Copper	2.12	2.37
Braden Copper	7.00	7.12
California Oil	291.00	293.00
Chino Copper	37.37	37.87
Green Can.	29.50	31.00
Miami Copper	22.00	25.00
Nevada Copper	14.87	15.00
Ohio Oil	156.00	160.00
Ray Cons. Copper	18.12	18.25
Standard Oil of N. Y.	192.00	193.00
Standard Oil of N. J.	424.00	427.00
Standard Oil (old)	1350 00	.....
Standard Oil (subs.)	925.00	955.00
Tonopah Mining	6.62	6.87
Tonopah Belmont	7.37	7.62
Tonopah Merger	.51	.53
Inspiration Copper	15.12	15.50
Goldfield Cons.	1.25	1.50
Yukon Gold	2.00	2.12

Porcupine Stocks.

	Bid.	Ask.
Apex	....	.01
Dome Extension	.07	07½
Dome Lake	.26	26½
Dome Mines	14.75	15.00
Eldorado	....	.01
Foley O'Brien	.15	.20
Hollinger	17.25	17.50
Jupiter	.06½	.06¾
McIntyre	1.30	1.50
Moneta	.02	.04
North Dome	....	.25
Northern Exploration	2.75	3.00
Pearl Lake	.09	.09½
Plenaurum	....	.35
Porcupine Gold	.09¾	.10
Imperial	.01½	.02
Porcupine Reserve	....	.06
Preston East Dome	.01½	.02
Rea	.15	.20
Standard	....	.01
Swastika	.04¼	.04½
United	....	.01
West Dome	.07	.11
Porcupine Crown	1.29	1.31
Teck Hughes	....	.26

Cobalt Stocks.

	Bid.	Ask.
Bailey	.05	.05¼
Beaver	.30	.31
Buffalo	2.05	.2.25
Canadian	....	.16
Chambers Ferland	.18½	.19½
City of Cobalt	.30	.35
Cobalt Lake	.55	.60
Coniagas	7.50	7.75
Crown Reserve	1.69	1.70
Foster	.06	.08
Gifford	.03	.04
Gould	.02	.02¼
Great Northern	.09½	.10
Hargraves	.02¼	.02¾
Hudson Bay	70.00	71.00
Kerr Lake	4.43	4.49
La Rose	1.75	1.77
McKinley	1.10	1.11
Nipissing	7.85	7.95
Peterson Lake	.23¾	.24
Right of Way	.04½	.06
Rochester	.02	.03
Leaf	.01½	.02
Cochrane	....	.04
Silver Queen	.03	.05
Timiskaming	.13	.13½
Trethewey	.24	.26
Wettlaufer	.06	.08
Seneca Superior	2.25	2.75

TORONTO MARKETS.

Jan. 12.—(Quotations from Canada Metal Co., Toronto):
- Spelter, 5 cents per pound.
- Lead, 5½ cents per pound.
- Tin, 39 cents per pound.
- Antimony, 8½ cents per pound.
- Copper, casting, 15 cents per pound.
- Electrolytic, 15 cents per pound.
- Ingot brass, 10 to 15 cents per pound.

Jan. 12.—Pig Iron—(Quotations from Drummond, McCall & Co., Toronto):
- Summerlee No. 1, $26.00 (f.o.b. Toronto).
- Summerlee No. 2, $25.00 (f.o.b. Toronto).

Jan. 12.—Coal—(Quotations from Elias Rogers Co., Toronto)·
- Anthracite, $8.25 per ton.
- Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

Jan. 9.—Connellsville coke (f.o.b. ovens):
- Furnace coke, prompt, $1.90 per ton.
- Foundry coke, prompt, $2.40 to $2.65 per ton.

Jan. 9.—Tin, straits, 36.87½ cents.
- Copper, Prime Lake, 14.50 cents.
- Electrolytic copper, 14.25 cents.
- Copper wire, 15.50 cents.
- Lead, 4.10 to 4.15 cents.
- Spelter, 5.25 to 5.35 cents.
- Sheet zinc (f.o.b. smelter), 7.50 cents.
- Antimony, Cookson's 7.37½ cents.
- Aluminum, 18.75 to 19.00 cents.
- Nickel, 40.00 to 45.00 cents.
- Platinum, soft, $43.00 to $44.00 per ounce.
- Platinum, hard, 10 per cent., $46.00 to 47.50. per ounce.
- Platinum, hard, 20 per cent., $49.00 to $51.50 per ounce.
- Bismuth, $1.95 to $2.15 per pound.
- Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London pence.
Jan. 1	....	26 7/16
" 2	57⅛	26 7/16
" 3	57⅛	26 7/16
" 5	57½	26 8/16
" 6	57⅜	26½
" 7	58	26¾
" 8	57¾	26⅝
" 9	57½	26½
" 10	57¾	26⅝
" 12	57¾	26⅝

FOR SCREENING AND CONVEYING COAL

INSTALL

"THE MARCUS"

HORIZONTAL SYSTEM

And Simplify Your Screening, Picking, Mixing and Loading Arrangements

WRITE FOR FULL PARTICULARS

"THE MARCUS" Combines Shaker Screen and Picking Table, thus Economizing in First Cost.

"THE MARCUS" is especially adapted for Fragile Coal, reduces breakage to a minimum.

"THE MARCUS" will convey 320 tons per hour and only absorb 7 horse power.

"THE MARCUS" screens out small to facilitate efficient picking, yet can be mixed with large at delivery end for Mine Run Coal.

"THE MARCUS" horizontal system greatly reduces the height of structure.

"THE MARCUS" system makes it possible to meet the varying demands of the market by enabling the different sizes of coal to be mixed.

SOLE RIGHTS FOR CANADA

HEAD, WRIGHTSON & CO., LTD.

CONSULTING ENGINEERS, MANUFACTURERS AND CONTRACTORS

ENGLAND, CANADA, SOUTH AFRICA AND AUSTRALIA

THE SOLE RIGHTS FOR THE UNITED STATES OF AMERICA ARE HELD BY MESSRS. ROBERTS AND SCHAEFER COMPANY OF CHICAGO

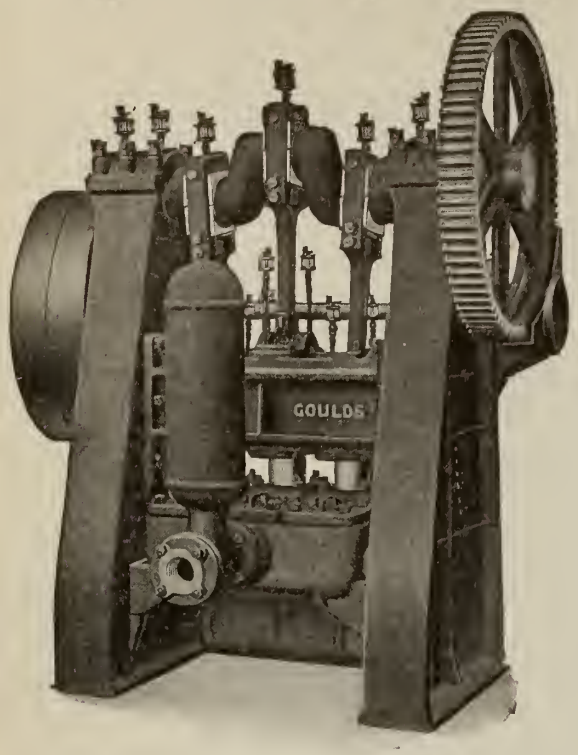
SPECIALTIES

The Marcus Screen, Conveyor and Washer. Complete Mine Equipment.
Coal Shipping, Gas Works Plant. Metalliferous Mining Machinery.
Cement Works Conveyors.

CANADIAN OFFICES:—84 MOSS STREET, VICTORIA, B.C.

DESIGNS AND QUOTATIONS FREE

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam** Shovels: **Specially Flexible Ropes** for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:—

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. **New Brunswick: W. H. Thorne & Co., Ltd., St. John.**
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, G. W.
Campbell & Deyel.
Carter, W. E. H.
Demorest, Stull & Low
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Forbes, H. L.
Graham, S. N.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Leckie, J. E.
Loring, F. C.
McEvoy, Jas.
Scott, O. N.
Segsworth, Walter E.
Smith, Alex H.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.
Woolsey, W. J.

British Columbia

Ashworth, James
Fowler, S. S.

FOREIGN-New York

Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Campbell & Deyell
Heys, Thos. & Son.

Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd

Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASHWORTH, JAMES
MEMB. S. W. I. E.
Consulting Mining Engineer,
General Manager Crows Nest Pass Coal Co.
1909—1911
1109 Hornby St. VANCOUVER, B. C

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 5199, Code: Bedford McNeill

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place
New York City

DEPENCIER, H. P.
Consulting Mining Engineer
Room 613, Dominion Express Bldg.,
MONTREAL.
Phone Main 4984 P. O. Box 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
Belleville, Ontario.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FORBES, H. L. M.Sc.,
Mining Engineer
77 Sparks Street., OTTAWA, CAN
Specialty: Mica Phosphate.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 Waldorf Court, Brooklyn, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

JOHNSON, W. S.
Phones { Office Main 6935 / Res Lachine 218
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LECKIE, J. EDWARDS,
Mining & Consulting Engineer,
Box 1555. - - Vancouver, B.C.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY JAMES
Mining Engineer,
Stair Building,
TORONTO.

MACARTHUR, J. S. & CO.,
of LONDON & GLASGOW
Mining Engineers and Metallurgists,
PORCUPINE, ONT.
Represented by
Wm. Thornton, A. I. M. M.
Geo. P. Dempster.

MCMEEKIN, A., B. Sc. O. L. S.
Mining Engineer and Ontario Land Surveyor
Mines and Mining Properties examined and reported upon
KENORA - - ONTARIO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

O. N. SCOTT, B. Sc.
MINING ENGINEER
DOMINION BOND BUILDING
(Cor. King and Yonge Sts.) TORONTO
Tel. Main 1585 Cable Address "Onscott"

MAURICE W. SUMMERHAYES
Mining Engineer,
McENANEY MINES
Schumacher P.O., - Ont.

SMITH SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

THOMAS, KIRBY
Mining Engineer
Examination and Valuation of Mining Properties
20 Broad St., Suite 1017, Annex, New York
Cable Address: "Kirthom," New York.
Code: Bedford-McNeill.

WALKER, T. L.
Geologist
Reports on Molybdenum and Tungsten Properties.
University of Toronto, TORONTO

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

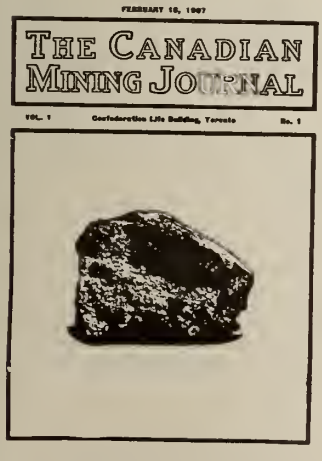
MINING PROPERTY FOR SALE
Gold Mining Claim, surrounded by very rich Mining Properties, near Kirkland Lake. Will sacrifice 25% of value for cash. The greatest opportunity ever offered.
Information promptly given. Apply, Box 9, CANADIAN MINING JOURNAL.

Smith & Travers Diamond Drill Company, Limited
Box 12, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

MINING PROPERTIES FOR SALE
Gold Mining Claims near Porcupine. A liberal proposition can be made to right parties, principals preferred. Information promptly given. Apply Box 99,
CANADIAN MINING JOURNAL
TORONTO

WANTED
Wanted a first-class Engineer to give valuation, and make a general report on Gold Mining Claim.
Apply with terms, Box 10,
CANADIAN MINING JOURNAL.

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL



The Canadian Mining Journal

WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

1085. Descriptive Sketch of the Geology and Economic Minerals of Canada. Accompanied by a geological and mineral map of Canada, by G. A. Young and R. W. Brock.

NEW BRUNSWICK and NOVA SCOTIA

1165. Memoir No. 18. Bathurst District, New Brunswick, by G. A. Young. Maps not yet published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1160. Memoir No. 17. Larder Lake District, Ont., and Adjoining Portions of Pontiac County, Quebec, by Morley E. Wilson.
1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1220. Memoir 29. Oil and gas prospects of the Northwest Provinces of Canada, by Wyatt Malcolm. Map not yet published.

BRITISH COLUMBIA

1206. Memoir No. 26. Geology and Mineral Resources of the Tulameen District, B.C., by Charles Camsell.
1255. Memoir No. 37. Portions of Atlin District, British Columbia, with Special Reference to Lode Mining, by D. D. Cairnes.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1042. Mineral Map of Canada. Scale 100 miles to 1 inch.
1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NOVA SCOTIA

1133. Map 13A. Kingsport sheet, Nova Scotia, No. 84. Scale 1 mile to 1 inch.
1208. Map 53A. Southeast Nova Scotia. Scale 4 miles to 1 inch.

NEW BRUNSWICK

1181. Map 35A. Reconnaissance Map of Parts of Albert and Westmoreland Counties, N.B. Geology and topography. Scale 1 mile 1 inch.

QUEBEC

1178. Map 32A. Larder Lake and Opasatika Lake, Nipissing, Abitibi and Pontiac, Ontario and Quebec. Geological. Scale 2 miles to 1 inch.

ONTARIO

750. Grenville Sheet. Parts of Counties of Ottawa, Argenteuil, Terrebonne, Two Mountains and Vaudreuil, Quebec and Carleton, Russell, Prescott and Glengarry, Ontario. Geology. Scale 4 miles to 1 inch. Reprint.
1177. Map 31A. Larder Lake, Nipissing District, Ontario. Geology. Scale 1 mile to 1 inch.
1244. Map 64A. Advance geological copy of map of Gowganda Mining Division and vicinity. Scale 1 mile to 1 inch.

ALBERTA

1132. Map No. 7A. Bighorn Coal Area, Alberta, by G. Malloch. Scale 2 miles to 1 inch.

BRITISH COLUMBIA

1260-1276. Maps 74A-90A. Geology of the Forty-ninth Parallel. Geology and topography of the International Boundary between British Columbia and the United States. Scale 1 mile to 1 inch, contour interval 100 feet.
1283. Map 94A. Taku Arm, Atlin District, B.C. Geology. Scale 4 miles to 1 inch.

YUKON and NORTH WEST TERRITORIES

1089. Map 9A. Explored Routes on parts of the Albany, Severn and Winisk Rivers. Scale 8 miles to 1 inch.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

WATERWORKS PUMPS

High Duty Horizontal Compound and Vertical Triple Expansion

PUMPING ENGINES

Capacities from One-Half Million to Thirty Million Gallons per twenty-four hours

Specifications on Request

The John Inglis Co., LIMITED

Boilermakers and Engineers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER---COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario
Branch Office: - - 806 Lumsden Building
Cor. Adelaide and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores
Manufacturers of
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

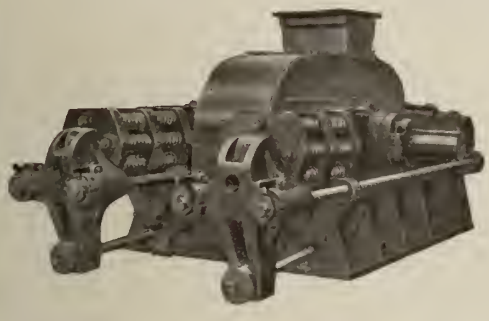
POSITION WANTED

Mechanical Construction Engineer and Draughtsman, experienced Designer and Erector of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc., seeks position. References.

Apply Box 8,
CANADIAN MINING JOURNAL, Toronto

ORE CRUSHING PLANTS

OF ALL CAPACITIES



Where uniform product and large capacity are required, rolls operate at lower cost for power and repairs than any other crusher.

OUR

"Anaconda" Roll

is especially adapted to crushing iron ore, trap rock, cement clinker, hard quartz and ores met with in the metal mining industry.

CANADIAN ALLIS-CHALMERS, LIMITED

HEAD OFFICE: TORONTO. DISTRICT SALES OFFICES: MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER, PRINCE RUPERT.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.
The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $10 an acre for SUPERIOR METALS when more than 20 miles distant from a railway and $20 an acre when less than 20 miles.
For INFERIOR METALS the prices are $2.00 and $4.00 an acre respectively.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co..... 22
Amatite Roofing 13
American Diamond Rock Drill Co. 16
Ashworth, James..... 23
Astley, J. W..... 23

B

Bartlett, C. O., & Snow Co..... 17
Bath, Henry & Son..... 28
Beatty, M. & Sons, Ltd..... 11
Bennet, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons..... 16
Blackwell, Geo. G., Sons & Co.... 28
British Columbia, Province of.... 18

C

Canadian Allis-Chalmers, Ltd. ... 29
Campbell & Deyell..... ..23 and 25
Canadian Bag Co..... 13
Canadian Bank of Commerce..... 8
Canadian Cleveland Drill Co..... 9
Canadian Copper Co..... 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Laboratories, Ltd..... 25
Canadian Northern Steamships ... 7
Canadian Ingersoll-Rand Co., Ltd. 3
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Capell Fan Co..... 16
Carter & Smith..... 23
Castellanos, A. W..... 16
Cohen, S. W..... 23
Colvocoresses, G. M..... 23
Consolidated Mining & Smelting Co. 28
Coniagas Reduction Co., Ltd..... 28
Curtis's & Harvey.....
.....Outside back cover
Can. Consolidated Rubber Co, Ltd.
.....inside front cover

D

Dept. of Mines, Canada..... 26
Deister Machine Co. 14
Delore Mining & Reduction Co.... 28
DePencier, H. P..... 23
Diamond Drill Contracting Co.... 16
Dominion Coal Co., Ltd..... 8
Dominion Bridge Co..... 16
Donald, Dr. J. T..... 25
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W..... 23

F

Ferrier, W. F..... 23
Fleck, Alex. 7
Flory, S., Mfg. Co..... 12
Forbes, H. L..... 24
Forbes, D. L. H..... 23
Fowler, S. S..... 23
Fraser & Chalmers, Ltd..... 4
Federal Engineering Co., Ltd. ... 31

G

Graham, S. N..... 23
Gray, John. 25
Greening, B., Wire Co., Ltd..... 10
Gwillim, J. C..... 23

H

Hadfield's Steel Foundry Co. 6
Handley, John. 24
Hardman, J. E..... 24
Hassan, A. A. 23
Haultain, H. E. T..... 24
Hersey, Milton Co., Ltd..... 25
Heys, Thos. & Son..... 25
Hille, F. 24
Holman Drill Co..... 20
Head, Wrightson & Co., Ltd..... 21

I

Inglis, John & Co., Ltd..... 27
Imperial Bank of Canada 2
Industrial & Technical Press..... 39
International Nickel Co. 8
International Engineering Works, Ltd. 11

J

James Ore Concentrator Co.....
.....Outside back cover
Jeffrey Mfg. Co., Ltd. 19
Johnson, W. S..... 24
Jones & Glassco..... 19
H. W. Johns-Manville Co., Ltd.... 9

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co..... 25
Leckie, J. Edwards..... 24
Loring, F. C..... 24
Lymans, Limited. 9
Lands of the Algoma Central and Hudson Bay Ry..... 36

M

Morton, B. K. & Co..... 18
MacArthur, J. S..... 24
McEvoy, James 24
McMeekin, A. 25
Mussens, Limited. .....
.....20 and front cover
Michigan College of Mines 7
Herbert Morris Crane & Hoist Co., Ltd. 10

N

Nova Scotia Steel & Coal Co..... 10
Nova Scotia, Province of..... 15
Northern Canada Supply Co., Ltd. 7
Northern Electric & Mfg. Co., Ltd. 5

O

Orenstein-Arthur Koppel Co..... 5
Oxford Copper Co. 8
Ontario, Province of 30

P

Paterson Mfg. Co..... 13
Peacock Bros. 6
Pyke, Jas. W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31

S

Stanley, W. F. & Co., Ltd..... 12
Schaaf-Regelman, E. 28
School of Mining, Kingston..... 13
Scott, O. N. 24
Segsworth, W. E..... 24
Smart-Turner Machine Co..... 12
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd.....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Sullivan Machinery Co..... 2
Summerhayes, Maurice W..... 24
Swedish Steel & Importing Co., Ltd. 12
Standard Underground Cable Co. of Canada, Ltd. 15
Siemens Co., of Canada, Ltd..... 35

T

Toronto University 2
Tyrrell, J. B..... 24
Thomas, Kirby 24

W

Waterous Engine Works Co., Ltd. 9
Willmott, A. B..... 24
Walker Bros. 6

Lanco Balata Belting

This belt has no equal in service giving qualities where the conditions change from wet to dry. It is equally reliable for all conditions except those of heat. It is made intensely strong and is impregnated by our own secret process with PURE balata gum. Write for booklet "The Main Drive."

Federal Engineering Co., Limited
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt, Ont.
Ledoux & Co., 99 John St., New York.
Thos. Hayes & Son, 124 onge St., Toronto.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Ball Mills—
Canadian Alis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Mussens, Limited.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried.A. G., Germany.
Mussens, Limited.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Limited.
Northern Canada Supply Co.
Jones & Glassco.
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineers Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd.
Thomas & William Smith.
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada), Limited.
Mussens, Limited.
Northern Canada Supply Co.

Blowers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried.A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.

Blast Furnace Plant—
Head, Wrightson & Co, Ltd.

Boilers
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
Canadian Ingersoll-Rand Co., Ltd.
The John Inglis Co., Ltd.

Buckets—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Limited.
Northern Canada Supply Co.

Buildings—Steel Frame
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd.

Cable — Aerial and Underground—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Limited
Mussens, Limited.

Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Limited.
Northern Canada Supply Co.

Cables—Wire—
Standard Underground Cable Co. of Canada, Ltd.

Carriers—
The Herbert Morris Crane & Hoist Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co

Case Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Cement Machinery—
Canadian Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.
Head, Wrightson & Co, Ltd.

Chains—
Jeffrey Mfg. Co.
Peacock Brothers.
Jones & Giassco.
Mussens, Limited.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.

Chain, Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell.
Thos. Heys & Son.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Limited.

Coal Handling Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd

Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Jeffrey Mfg. Co.
Head, Wrightson & Co., Ltd.

Coal Punchers—
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Limited.
Peacock Brothers.
Head, Wrightson & Co., Ltd.

Compressors—Air—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd.
Laurie & Lamb.
Canadian Westinghouse.
Can. Ingersoll-Rand Co., Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs.
Canadian Allis-Chalmers, Ltd.
Diester Machine Co.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Canadian Allis-Chalmers, Ltd.
Peacocks Brothers.
Mussens, Limited.
Northern Canada Supply Co.

Condensers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Brothers.
Laurie & Lamb.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.

Conveyors—Belt—
Head, Wrightson & Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Brothers.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Waterous Engine Works.
Canadian Fairbanks-Morse Co., Ltd.

Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
SmartTurner Machine Co.
Peacock Brothers.
Mussens, Limited.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany.

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Gantry—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Hand Power—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Lymans, Limited.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Hadfields Steel Foundry Co.

Cyanide Plants—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Roessier & Hasslacher.
Mussens, Limited.
Thomas & William Smith.
Peacock Brothers.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Limited.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons.
Mussens, Limited.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Brothers.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Standard Diamond Drill Co.

Drills—Diamond.
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Canadian Ingersoll-Rand Co.
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Siemens Co. of Can., Ltd.
Canadian Ingersoll-Rand Co.

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Limited.
Orenstein-Arthur Koppel Co.

Dynamite—
Curtis & Harvey (Canada), Limited.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Limited.
Peacock Brothers.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Elevators—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Peacock Brothers.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Brothers.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Roberts & Schaefer Co.
Head, Wrightson & Co, Ltd.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Brothers.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Mussens, Limited.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Brothers.
M. Beatty & Sons.
Canadian Westinghouse.
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Brothers.
The John Englis Co., Ltd.
Can. Fairbanks-Morse Co.

Engines—Oil—
Peacock Brothers.
Can. Fairbanks-Morse Co.

Engines—Steam—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Mahine Co.
Robb Engineering Co.
S. Fiory Mfg. Co.
Alex. Fleck.
Peacock Bros.
M. Beatty & Sons.
Laurie & Lamb.
Mussens, Limited.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Brothers.
Mussens, Limited.

Feeders—Ore—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Mussens, Limited.

Filters—
Krupp, Fried, A. G., Germany.

Friction Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co. Ltd.

Forgings—
M. Beatty & Sons.
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Brothers.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :	Halifax
QUEBEC :	Montreal
ONTARIO : Toronto, Cobalt, South Porcupine, Port Arthur,	Kingston
MANITOBA :	Winnipeg
ALBERTA :	Edmonton
BRITISH COLUMBIA : Vancouver, Victoria, Nelson,	Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.,
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krupp, Fried, A. G., Germany.
Lymans, Limited.
Mussens, Limited.

Fuse—
Peacock Brothers.
Curtis & Harvey, (Canada). Limited.
Canadian Westinghouse.
Canadian Explosives.
Mussens, Limited.
Northern Canada Supply Co.

Gears—
Canadian Westinghouse.
Krupp, Fried, A. G., Germany.
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada., Ltd.

Girders—Steel—
Dominion Bridge Co.

Gravity Lowering Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Hangers—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Heaters—Feed Water—
Mussens, Limited.
Laurie & Lamb.
Canadian Westinghlouse.
Peacock Brothers.
Fraser & Chalmers, Ltd.

High Speed Steel Twist Drills—
Mussens, Limited.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co. Ltd
Peacock Brothers.
Krupp, Fried, A. G., Germany.
Mussens Limited.
Canadian Allis-Chalmers, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
Waterous Engine Works.
M. Beatty & Sons.
Can. Fairbanks-Morse Co.
Fraser & Chalmers Ltd.
Northern Canada Supply Co.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Canadian Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Limited.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Can. Cleveland Drill Co.
Northern Canada Supply Co.

Jacks—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Canadian Allis-Chalmers, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Limited.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Lamps—Sofety—
Canadian Explosives.
Peacock Brothers.
Ackroyd & Best.
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works.
Northern Canada Supply Co
Jones & Glassco.

Locomotives—electric—
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Siemens Co. of Can., Ltd.

Locomotives—Steam—
Mussens, Limited.
Canadian Westinghouse.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Ore Sacks—
Can. Bag Co.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining & Smelting Co. of Canada.
Krupp, Fried, A. G., Germany.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Limited.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Peacock Brothers.

Pipes—Rivetted—
Consolidated Mining & Smelting Co.
Peacock Brothers.
Laurie & Lamb.
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.

Pipe Fittings—
Can. H. W. Johns-Manville.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Westinghouse.
Northern Canada Supply Co.

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Brothers.
Jones & Glassco.

Producer—Gas—
Krupp, Fried. A.G., Germany.
Mussens, Limited.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
Smart-Turner Machine Co.
Krupp, Fried. A.G., Germany.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.
Laurie & Lamb.
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Canadian Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Alex. Fleck.
Mussens, Limited.
Smart-Turner Machine Co.
Peacock Brothers.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Pneumotic—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Smart-Turner Machine Co.
Canadian Ingersoll-Rrand Co.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Can. Ingersoll-Rand Co.

Pumps—Steam—
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
Alex. Fleck.
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A.G., Germany.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany.

Rolls—Crushing—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Fraser & Chalmers, Ltd.
Canadian Allis-Chalmers. Ltd

Roofing—
Patterson Mfg. Co.
Dominion Bridge Co.
Mussens, Limited.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.
Head, Wrightson & Co., Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers, Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories.
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany.
Thos. Hays & Sons.

Screens—
Mussens, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Self Landing, Self Delivery Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Smart-Turner Machine Co.
Peacock Brothers.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany.

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shavels—Steam—
Mussens, Limited.
M. Beatty & Sons.

Slime Tables—
Diester Concentrator Co.
James Ore Concentrator.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Smelting Machinery—
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Can. Allis-Chalmers.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drill—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A. G., Germany.
Canadian Ingersoll-Rand Co. Ltd.
Peacock Brothers.
Swedish Steel & Imp. Co, Ltd

Steel—Tool—
Mussens, Limited.
Thos. & Wm. Smith.
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co, Ltd

Surveying Instruments—
Peacock Brothers.
W. F. Stanley.
C. L. Berger.

Switchboards—
Canadian Westinghouse.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Limited.
Krupp, Fried. A. G., Germany,
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Limited.
B. Greening Wire Co.
Can. Allis-Chalmers Ltd

Transformers—
Canadian Westinghouse.
Can. Fairbanks-Morse Co.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Transits—
C. L. Berger & Sons.
W. F. Stanley.
Peacock Brothers.

Tractors—Oil—
Canadian Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Limited.
Krupp, Fried. A. G., Germany,
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse.
Peacock Brothers.
Laurie & Lamb.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.
Krupp, Fried. A. G., Germany,
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Winding Engines—
Waterous Engine Works.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Can. Ingersoll-Rand Co., Ltd.
Fraser Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Wire Cloth—
Can. Allis-Chalmers, Ltd.
Mussens, Limited.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Standard Underground Cable Co. of Canada, Ltd.

Wire—Magnet—
Standard Underground Cable Co. of Canada. Ltd.

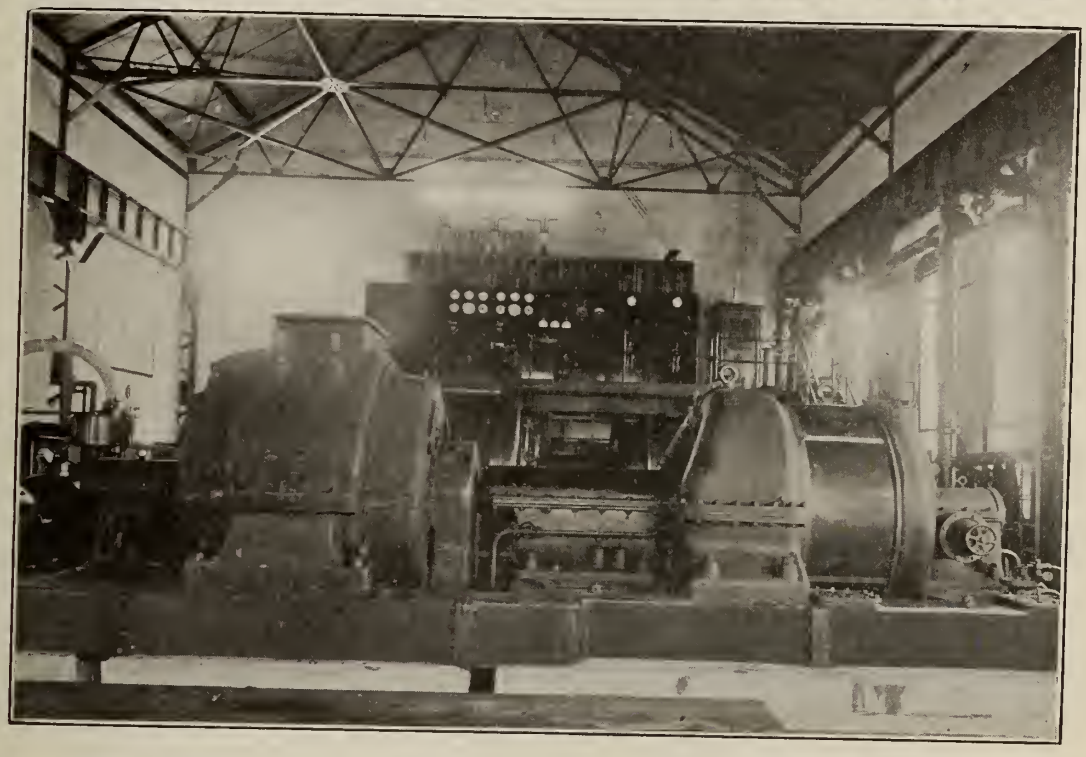
Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS—SCHUCKERT | SIEMENS & HALSKE



Siemens 2,500 K.W., 25 cycle, 6,600 Volt Turbo Generator with Switchboard, supplied to the Dominion Coal Company, Nova Scotia.

The following Siemens **Turbo Generators** have been supplied or are on order for Canada.

1—4000 K.W. Edmonton.
1—3000 K.W. Regina.
I—2500 K.W. Dominion Coal Co.
1—2000 K.W. Dawson City
1—2000 K.W. Dawson City.
1—2000 K.W. Dawson City.
1—2000 K.W. Edmonton.
1—1500 K.W. Regina.
1—1500 K.W. Regina.
1—1500 K.W. Moose Jaw.
1—1200 K.W. Lethbridge.
1— 750 K.W. Nova Scotia Steel & Coal Co.
1— 675 K.W. Medicine Hat.
1— 675 K.W. Medicine Hat.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Wayagamack Pulp & Paper Co.

The Siemens Companies manufacture Turbo Generators in **single units of 30,000 H.P.**

"The Siemens Companies undertake the complete electrical equipment of mines, collieries, steel works, rolling mills, pulp and paper Mills, and electrical plants of every description, and specialize in **Electric Hoisting Engines.**"

Siemens Company of Canada, Limited

HEAD OFFICE
TRANSPORTATION BUILDING - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Drive your compressors with Westinghouse Synchronous Motors and reduce your power cost.

Westinghouse Synchronous Motor

IN some compressor installations, direct connected, Westinghouse self-starting synchronous motors have actually paid for themselves in a few years by the reduction they caused in the power bills.

How is this done? These motors will raise your power factor. This means, if you make your own power, directly increasing the capacity of your present generators, transformers and transmission lines; improving the voltage regulation, and raising the efficiency of your entire installation.

Many central stations give better rates for a high power factor installation than for a low one.

Then, too, these motors require the least floor space, cost less to install than other types, and have the highest efficiency.

Their first cost is not higher than for motors of other types and, in very large sizes, it is less.

Write to-day for complete information regarding Westinghouse Synchronous Motors and their application.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

— FOR REGULATIONS, MAPS, ETC., APPLY TO —

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M. A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— Published by —

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

— which also publishes —

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

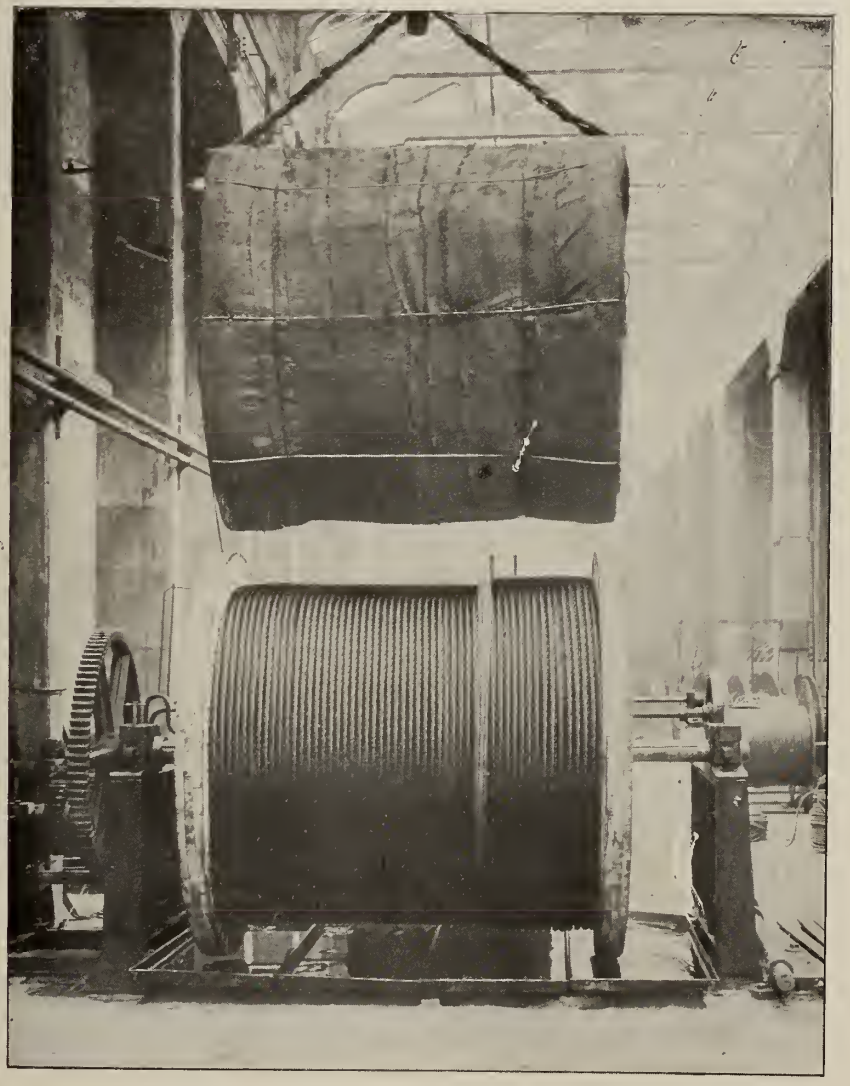
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For MINING:—
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.

The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

Use
"MOLE" BRAND

An Explosive of Great Merit

Curtis's & Harvey
(CANADA) LIMITED

MONTREAL
400 St. James St.

COBALT
Royal Exchange Bldg.

FEBRUARY 1, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 3

THE DRILL THAT DRILLS

Holman Steel Rock Drills are not only low in maintenance costs but are fast drilling machines.

On a well known Cobalt property ONE Holman 3¼ Steel Rock Drill drove a drift in DIABASE, 8 feet by 6 feet by 138 ft. long, in fifty-four shifts.

AVERAGE ADVANCE Per shift 2.55 feet.

This mine has the hardest rock in the Cobalt Camp.

Size for size the Holman Steel Rock Drill will bore more footage over long periods of time than any Rock Drill on the market.

START THE NEW YEAR RIGHT

by ordering

HOLMAN STEEL ROCK DRILLS

THE DRILL YOU WILL FINALLY BUY

Write for Catalogue No. 51 to the nearest office of the CANADIAN SALES AGENTS

MUSSENS LIMITED

MONTREAL, 318 St. James St. TORONTO, 155 West Richmond St. COBALT, Opp. Right of Way Mine WINNIPEG, 259-261 Stanley St. CALGARY, 10th Ave. and 3rd St. E.

VANCOUVER 101 Water St. QUEBEC 31 St. Louis St. ST. JOHN, N.B. 57 Symthe St. HALIFAX 78 Granville St.

THE JOURNAL OF COMMERCE WITH WHICH IS INCORPORATED The Shareholder

TWO of the oldest and most reliable Weekly Journals, recently amalgamated to strengthen the work heretofore done by each in the field of Commerce, Finance, Insurance and Industry. Editor, *J. C. Ross, M.A.*

Canada's greatest asset is her natural resources and the commodities by which she is best known are the products of industries engaged in the development of these resources. Canadian **ASBESTOS, NICKEL** and **COBALT** control the Markets of the world for these commodities, while her **SILVER, PULP** and **PAPER,** and **GRAIN** and **GRAIN PRODUCTS** are dominant factors of the world's supplies. The only Periodicals which are devoted entirely to these industries are :

CANADIAN MINING JOURNAL, published twice a month. Editor, *Reginald E. Hore, B.A.*

PULP AND PAPER MAGAZINE OF CANADA, published twice a month. Editor, *A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST, published once a month. Editor, *J. G. Adams, B.A.*

CANADIAN TEXTILE JOURNAL, a monthly periodical devoted entirely to Textile Manufacturing, is published from the same Offices. Editor, *E. Stanley Bates.*

In addition to publishing the above mentioned Journals, we are especially equipped to do all kinds of

FINE BOOK, CATALOGUE AND JOB PRINTING

MONTREAL OFFICE
Industrial and Educational Press, Limited
Read Building

TORONTO OFFICE:
Industrial and Technical Press, Limited
44-46 Lombard St.

Lindgren— MINERAL DEPOSITS

For Sale by the

Canadian Mining Journal

44-46 Lombard St. Toronto

By WALDEMAR LINDGREN, Professor of Economic Geology, in in charge of the Department of Geology, Massachusetts Institute of Technology ; Geologist, United States Geological Survey.

883 *pages, 6x9, 257 illustrations,* $5.00 (21s) *net, postpaid*

For many years Mr. Lindgren has been Geologist of the United States. Geological Survey.

In this time he has come to be generally recognized as the leading authority on ore deposits.

The publication of this work on "Mineral Deposits" has been anticipated throughout the world.

It is the first book to attempt to cover within reasonable space both metallic and non-metallic minerals, except coal and oil.

—CONTENTS—

Introduction.
Deposition of Minerals.
The Flow of Underground Waters.
The Composition of Underground Waters.
The Chemical Work of Underground Waters.
The Origin of Underground Water and its Dissolved Substances.
The Spring Deposits at the Surface.
Relations of Mineral Deposits to Mineral Springs.
Folding and Faulting.
Openings in Rocks.
Form, Structure and Texture of Mineral Deposits.
Ore Shoots.
Classification of Mineral Deposits.
Deposits Formed by Mechanical Processes of Transportation and Concentration ; Detrital Deposits.
Deposits Formed by Chemical Processes of Concentration in Bodies of Surface Waters.
Deposits Formed by Evaporation of Bodies of Surface Waters.
Deposits Formed by Processes of Rock Decay and Weathering.
Deposits Formed by Concentration of Substances Contained in the Surrounding Rocks by Means of Circulating Waters.
Deposits Formed by Regional Metamorphism Formed by Zeditisation.
Deposits of Native Copper in Basic Lavas.
Lead and Zinc Deposits in Sedimentary Rocks in their Genetic Connection with Igneous Rocks.
Deposits Formed Near the Surface by Ascending Thermal Waters and in Genetic Connection with Igneous Rocks.
Deposits Formed at Intermediate Depths by Ascending Thermal Waters and in Genetic Connection with Intrusive Rocks.
Veins and Replacement Deposits Formed by Hot Ascending Waters at High Temperature and Pressure and in Genetic Connection with Intrusive Rocks.
Deposits Formed by Processes of Igneous Metamorphism.
Mineral Deposits of Pegmatite Dikes.
Mineral Deposits Formed by Concentration in Molted Magmas.
Metamorphosed Deposits.
Oxidation of Metallic Ores.
Calculation of Analysis and Representation by Diagrams.

Rock & Power Machinery

Limited

P. H. MOORE - - General Manager

Late Manager Mining, Crushing and Cement Machinery
Dept. for Canadian Allis-Chalmers Limited.

REPRESENTING:

THE EXETER MACHINE WORKS, Pittston, Pa.

Electric Overhead and Traveling Cranes, Locomotive Steam and Electric Cranes, Belt Conveyors, Industrial Railways and Cars, Orange Peel Buckets, Clam Shell Buckets, Feed Water Heaters, Concrete Mixers, etc.

KENNEDY MANUFACTURING & ENGINEERING CO., New York.

Cement Making Machinery, Rock and Ore Crushing Equipment.

OTTUMWA IRON WORKS, Ottumwa, Iowa.

Steam and Electric Hoists.

ERIE ENGINE WORKS, Erie, Pa.

Steam Engines, Boilers and Portable Outfits.

McKIERNAN-TERRY DRILL CO., New York.

Rock and Core Drills, Air Compressors, etc.

A. MILNE & CO., New York.

FJAB Hollow and Solid, Rock Drill Steel.

Inquiries Answered Promptly and Estimates Furnished.

HEAD OFFICE:
12 King St. East, Toronto

BRANCH OFFICES:

VANCOUVER; CALGARY; WINNIPEG; SUDBURY; COBALT; OTTAWA; MONTREAL; HALIFAX,
AND IN THE KING EDWARD HOTEL, TORONTO

Imperial Bank
of Canada

Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Paid Up	6,925,000
Reserve and Undivided Profits	8,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

The Latest and Most Up-to-date Lamp on the market is our

Hailwood's Improved Safe Miners' Safety Lamp

with its many new and novel features, including
Impregnable Magnetic Lock,
Hailwood's Patent Underground Lamp Re-lighting Machines,
which are absolutely flame and fool-proof, safe, simple and strong.

SOLE MAKERS

Ackroyd & Best, Ltd.

The World's Safety Lamp Experts

MORLEY, - LEEDS, ENGLAND

For full particulars apply :

ACKROYD & BEST, LTD.

No. 2 Arrott Power Buildings, Barker Place, Pittsburgh, Pa., U.S.A.

Telephone Nos. { P. & A. Tel. Main 2217. Bell Grant 1619.

UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

For Calendar and other information apply to the Secretary,

A. T. LAING

HOLED THROUGH!

On December 10, the Mount Royal Tunnel, at Montreal, 3¼ miles long, was holed through, after 15 months' constant work.

A World's Record for hard rock tunneling was set in this work, last May, when 810 feet of single heading were driven in 31 working days, with

SULLIVAN WATER DRILLS

Since May, more than 6000 feet of tunnel have been driven, in two headings, or an average advance of 480 feet per heading per month.

SULLIVAN ROCK DRILLS have been used exclusively. Their unusual speed and freedom from drill troubles, coupled with efficient organization and scientific planning, are responsible for this remarkable tunnel performance.

A report on the Mount Royal Tunnel is given in *Mine and Quarry* for January. Ask for it.

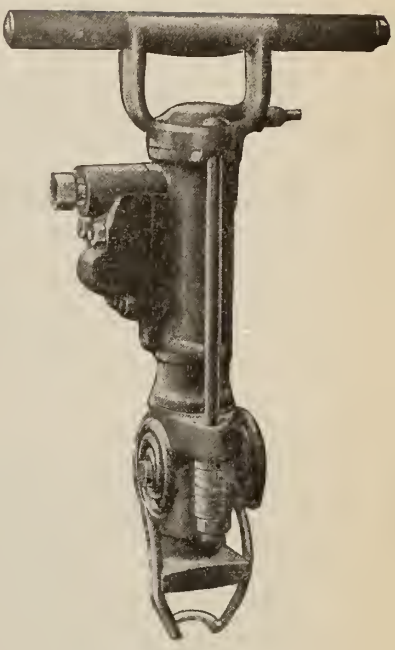
AIR COMPRESSORS DIAMOND DRILLS COAL CUTTERS HAMMER DRILLS

SULLIVAN MACHINERY CO.

122 SOUTH MICHIGAN AVENUE, CHICAGO. 30 CHURCH STREET, NEW YORK.

COBALT NELSON, B.C. VANCOUVER MONTREAL

How About the "Heart Action" of Your Drills?



The Jackhamer—Used extensively for sinking and down holes of moderate depth.

The Valve is the "heart" of a rock drill. Every function of the drill, as a drill, depends upon the character of its valve.

The valve determines the economy (or otherwise) of air or steam; the character of the blow; the speed of drilling. **In fact the valve action makes or mars the operation of the drill.**

Consider the "Butterfly" valve. Note first of all its simplicity, as pictured here—two sturdy wings on a centre body—all of toughest steel. Can you conceive of anything more simple—stronger—less liable to get out of order?

The ports are not opened or closed by a sliding movement, but by a movement like opening a book. Can you imagine an arrangement with less opportunity for wear?

The very slight "lift" of the valve from its seat gives an enormous port opening—**actually larger than the area of the ports themselves.** No chance here for "wire drawing" or back pressure, or slow, sluggish movement.

This "feather-weight" valve is moved by slight differences of pressure on two of its broad faces. And because it is so light **the movement of the valve is instantaneous;** while the impact on seating is so small as to be in no way injurious.

Here you have an oil-toughened, heat-treated valve of tremendous strength, working in a valve chest of simple construction with large unrestricted ports.

Because there is no wear to valve or seats—because the seating is complete and positive—there can be no leakage and waste of air or steam.

When you have fully grasped the distinctive features of this "Butterfly" valve, you'll understand why the "Jackhamer" and "Butterfly" Stopers and Plug Drills (all using the "Butterfly" valve) hit harder, drill faster, do more work per unit of power used, than any other drills you can buy.

And these are the very qualities you want in your drill—aren't they?

CANADIAN INGERSOLL-RAND CO., LIMITED.

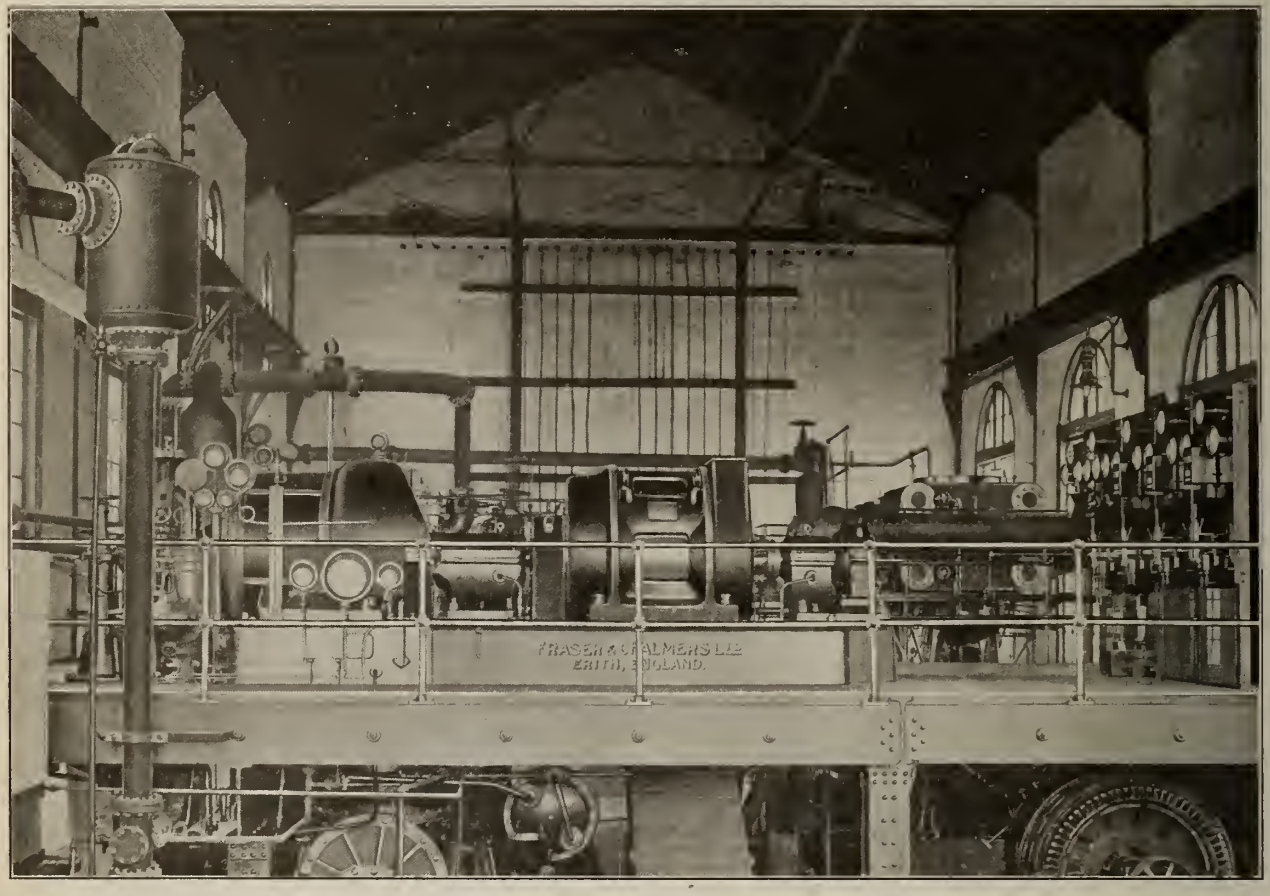
COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

IS YOUR GENERATING EQUIPMENT OVERLOADED?

Why not utilize the exhaust steam from your winding engines and fans to produce additional electric power.



750 Kilowatt Mixed Pressure Turbo-Generator, at a Colliery in Nova Scotia, utilizing the exhaust steam from two Compound Engines.

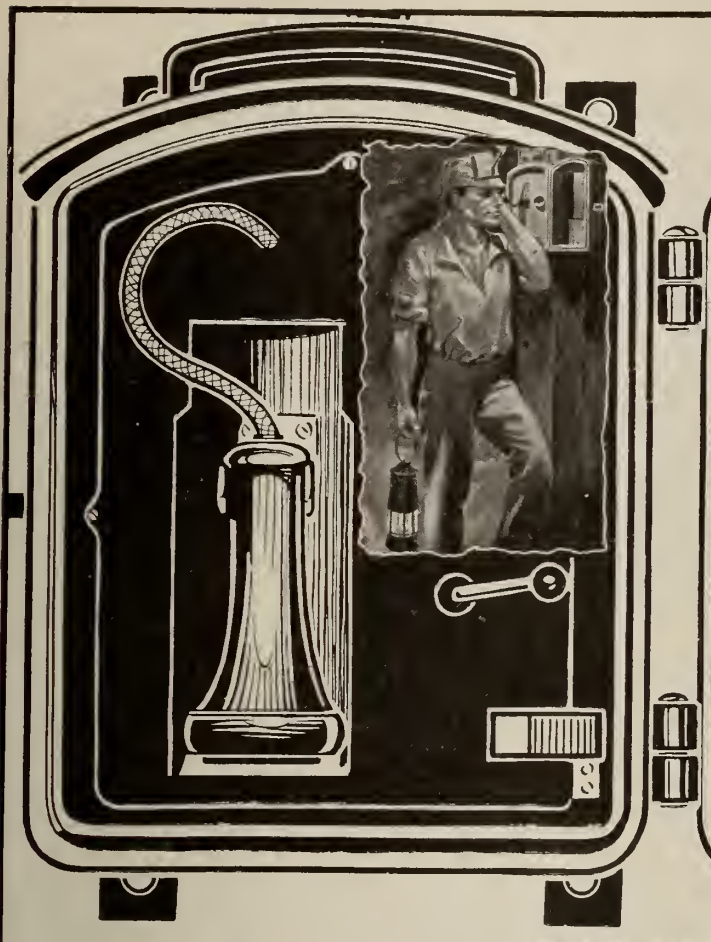
With our simplified mixed pressure governing gear, no heat accumulator is necessary to efficiently use an intermittent supply of exhaust steam.

FRASER & CHALMERS

LIMITED

Canadian Branch :

4 PHILLIPS PLACE - - - - - MONTREAL, P.Q.



MINE TELEPHONES

Bring every part of the mine into instant communication.

In emergency, warning can be flashed to every part.

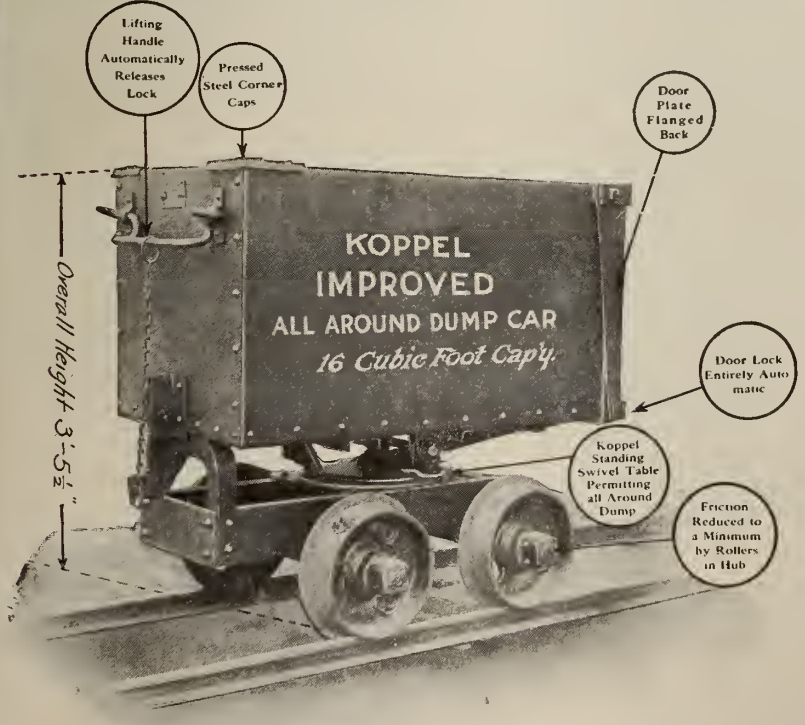
Even under ordinary conditions it is invaluable changing the mine from a number of disjointed departments isolated by distance, to a compact organization working together with the greatest efficiency under the one head.

Our nearest house will gladly send a man to tell you all about Northern Electric Mine Telephones.

The Northern Electric and Manufacturing Co., Ltd.

Montreal Winnipeg Edmonton
Halifax Regina Vancouver
Toronto Calgary Victoria

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Cap'y.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

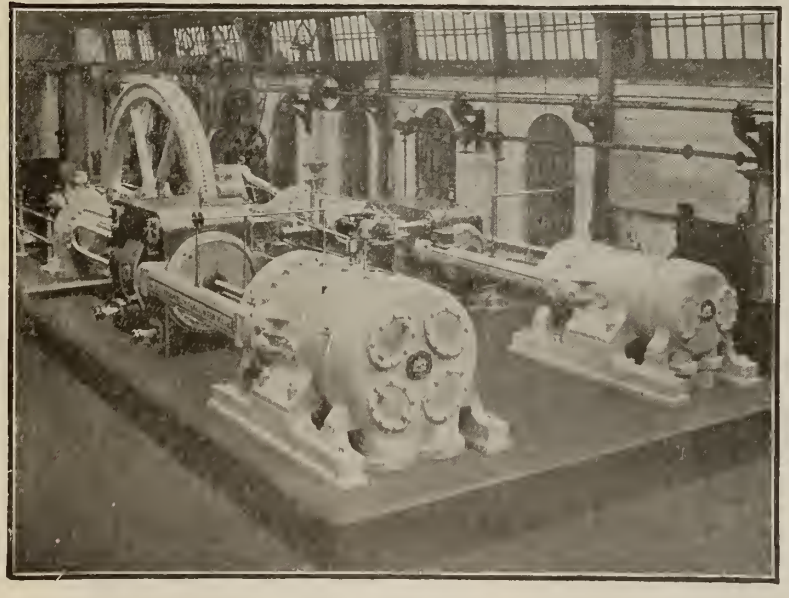
SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

THE SUPREME METAL
FOR WEARING PARTS

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N.B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering enginecring courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

The Canadian Bank of Commerce

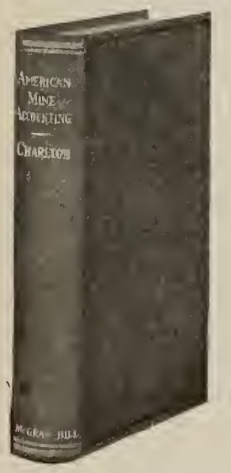
PAID-UP CAPITAL, $15,000,000
RESERVE - - 13,500,000

DRAFTS ON FOREIGN COUNTRIES

Arrangements have recently been completed under which the branches of this Bank are able to issue Drafts on the principal points in the following countries.

Austria-Hungary	Fr'ch Cochin-China	Norway
Belgium	Germany	Persia
Brazil	Great Britain	Phillipine Islands
Bulgaria	Greece	Roumania
Ceylon	Holland	Russia
China	Iceland	Servia
Crete	India	Siam
Denmark	Ireland	South Africa
Egypt	Italy	Straits Settlements
Faroe Islands	Japan	Sweden
Finland	Java	Switzerland
Formosa	Manchuria	Turkey
France	Mexico	West Indies and elsewhere

No Delay in Issuing. Full Particulars on Application.



American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages*, 6x9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

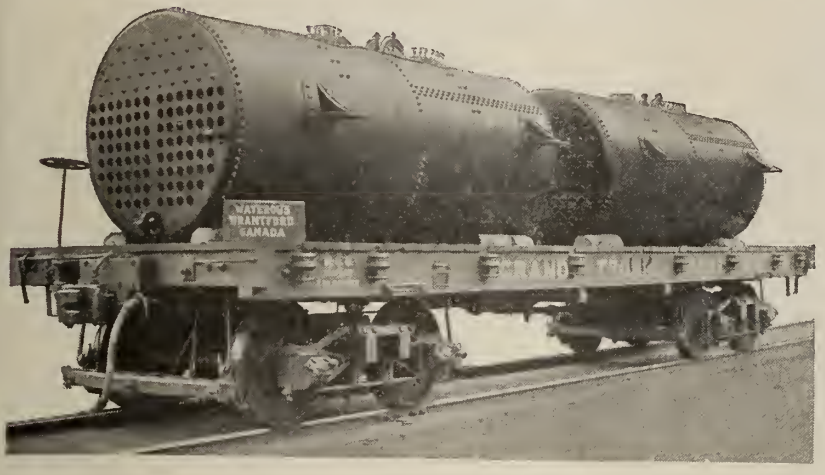
43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

BOILERS FOR MINE WORK



YOU will find Waterous Return Tubular Boilers in use in the largest Power Plants, industrial and municipal, in Canada. They are chosen where service counts.

Economical of fuel, these boilers carry lots of steam in reserve for use in emergencies. They can be used with hard and dirty water, are easily cleaned and taken care of. They cost comparatively little new—their upkeep expenses are negligible.

We build all sizes up to 72″ x 18′ and are in a position to supply most of them from stock. If not, we can turn your order out in fast time. Our prices are reasonable—our work is right.

The Waterous Engine Works Co., Limited

BRANTFORD - CANADA

SARTORIUS BALANCE

MODEL

"AMERICA"

WRITE FOR DESCRIPTIVE CIRCULAR

LYMANS, LIMITED

MONTREAL

Few Repairs

It is not so much how many holes a rock drill will put in per shift—but rather how long it will stay down in the mine. We absolutely guarantee that

"The Cleveland"

Stope Drill will not only do as much work as any drill made, but it will go longer without any repairs, takes less time to make the repairs, and gives better satisfaction all the time. And that is some guarantee.

TRY ONE

Bulletin 40-A Mailed Free.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street - TORONTO

GREENING'S WIRE ROPE

Our Mining Ropes are especially constructed to suit the requirements for HOISTING or HAULING.

Crucible Cast Steel
Best Plow, Acme Brand,
extra high breaking strain for deep shafts.

Regular Lay Lang's Lay

Wire Rope Fittings
Wire Rope Grease

ASK FOR OUR ROPE CATALOGUE

The
B. Greening Wire Co.
Limited

Hamilton, Ont. - Montreal, Que.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 1 4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: **NEW GLASGOW, NOVA SCOTIA**

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Won't this ROBB

MINE HOISTING ENGINE

just suit you ?

Two Robb-Armstrong side-crank engines, 22 inches diameter by 42 inches stroke. Engine bearings hard babbit.

Two Drums 8 feet in diameter, 58 inches wide. Bronze sleeves.

New, complete, with steam brake, steam-operated clutch, throttle valve, etc.

FULLY GUARANTEED.

For Photos, Drawings, etc., write to

International Engineering Works Limited
AMHERST, N.S.

Transportation Building. Montreal
Traders Bank Building, Toronto
39-49

"BEATTY"

Material Handling Plant

Hoisting Engines
Clamshell Buckets
Steel Derricks
Derrick Irons
Centrifugal Pumps
Dipper Dredges
Steel Scows, Etc.

Your requirements for anything in this line can be promptly filled by us, for we have a big stock of finished plant ready for immediate shipment, so are in fine shape to serve you.

Let us know your needs—we can interest you.

M. BEATTY & SONS, Limited
WELLAND, ONTARIO

AGENTS:
H. E. Plant, 1790 St. James St., Montreal.
H. W. Petrie, Ltd., Toronto
E. Leonard & Sons, St. John, N.B.
R. Hamilton & Co., Vancouver
A. R. Williams Machinery Co., Winnipeg

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records
Year by year they increase by Leaps and Bounds.

The Reason :

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

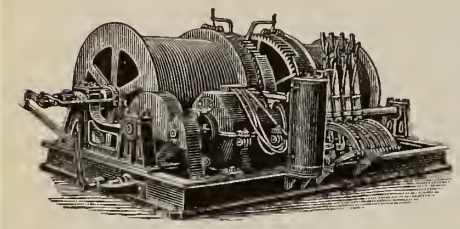
HEAD OFFICE AND FACTORY TORONTO
BRANCH FACTORIES WINNIPEG AND MONTREAL

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

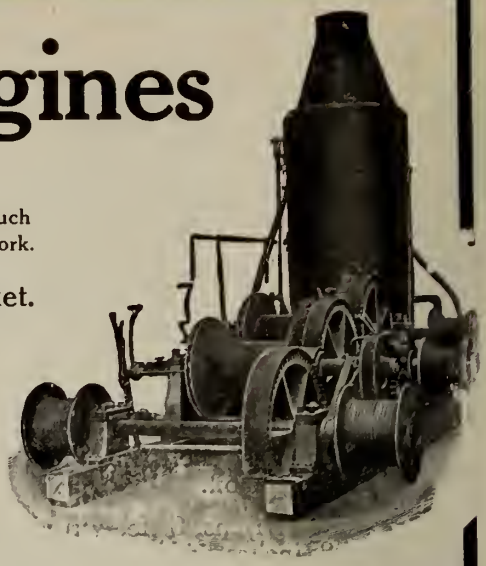


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

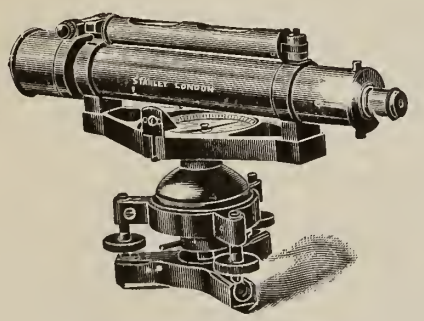
SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade **STANLEY** Mark

The largest manufacturers of

Surveying and Drawing Instruments

in the world.



"Stanley Quick-Setting-Up Level"

Please send for our K 35 Catalogue (post and duty free) and compare our prices with those of other first-class makers.

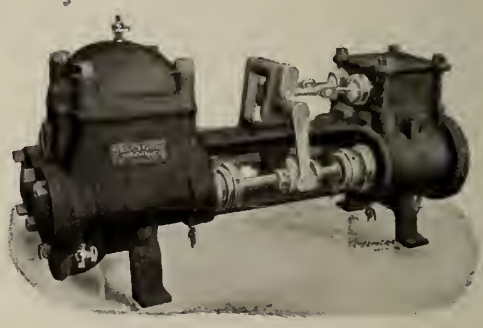
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, London, W.C.

Head Office and Showrooms:

286, High Holborn, London, England

Do You Want High Class Pumping Machinery at Reasonable Prices?



If so, write

The Smart Turner Machine Co.
LIMITED

Hamilton, Canada

BAGS!

Jute Cotton Duck

FOR

ASBESTOS COAL ORE

CONCENTRATES

FLOUR GRAIN FEED

PRINTING A SPECIALTY

The Canadian Bag Company Limited

Head Office: Montreal

TORONTO WINNIPEG

Amatite ROOFING

Figure It Out Yourself!

THE proposition is so simple that it hardly needs figuring. It is simply this: Most of the ready roofings on the market have a smooth surface which *requires painting every year or two.*

Amatite has a real mineral surface that *needs no painting.*

The cost is about the same.

If you buy a roofing that needs painting, you must figure on the expense of paint and the labor. If you neglect to paint it the roof soon falls apart.

Anyone who will spend a few moments investigating the proposition cannot help but decide on Amatite. Sample and booklets free on request.

THE PATERSON MFG. CO., Limited

Montreal, Toronto, Winnipeg, Vancouver, St. John, N.B., Halifax, N.S. Sydney, N.S.

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets. Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

All Ready!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

THE PARRAL TANK SYSTEM OF SLIME AGITATION

Parral Tank

Patented in
The United States, Canada, Mexico, etc.

No Bridge or Side Structures
No Belts or Gears
No Interior Moving Parts
No Centrifugal Pumps

Canadian Patent No. 139,537

Most Efficient—Most Economical—Simplest

Modus Operandi

The pulp is continuously transferred by compressed air through the lift pipes from top to bottom of the tank charge where its spouting force creates a Rotary flow which extends from top to bottom of the charge, keeping the solution and solid constituents in proper proportional mixture throughout the treatment period.

Cyanidation

Employed successfully for years in Cyanide Plants agitating the slime-pump of Gold and Silver ores.

Copper Ore and Flue Dust

This is the only practical system for agitating the slime of Copper Ore and Flue Dust in acid solution. For this purpose the tank, transfer-pipes and air nozzles are made entirely of wood.

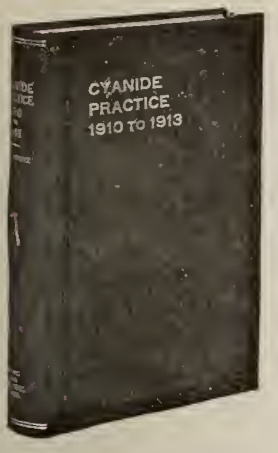
Agitation, settlement, decantation dilution, re-agitation and water-washing n same tank or in any series of tanks designed by metallurgists.

Write for full particulars to

Bernard MacDonald, 1005 Fair Oaks Ave., South Pasadena, California

The Jenckes Machine Co., Sherbrooke, Que.,
Canadian Manufacturers

CYANIDE PRACTICE
1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.

140 illustrations

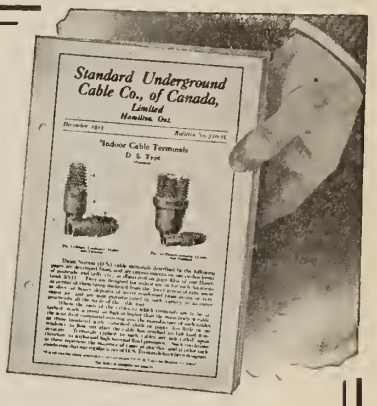
Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been lassified and grouped under the following headings:
Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Let us send you this new Bulletin



It is filled with valuable information for the buyer and user of cable terminals. There are tables of dimensions, weights, voltages, etc., that should be in your files. Note carefully the following:

Table of Contents

General Description of D. S. Terminals.
Regular Types of D. S. Terminals.
Inner Seal Terminals.
Wiped Joints vs. Clamped Joints.
Separation and Insulation of Conductors.
Insulating Compounds.
Terminals for Ordinary Service.
Terminals for Special Service.
Instructions for Ordering and Installing.

A card to our nearest office will bring your copy of this book. Write now.

Standard Underground Cable Co. of Canada, Limited
Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, for all purposes, also Cable Accessories.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

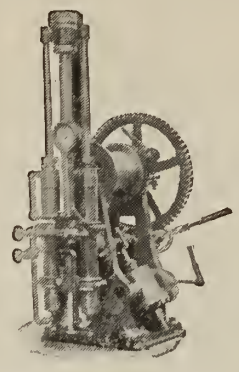
For Prospecting

Machines of all Capacities.

Product of over 35 years experience.

Take out a Solid Core.

Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

The Capell Patent Fans

UNDER IMPROVED PATENTS

1,600 Mine Fans in use.

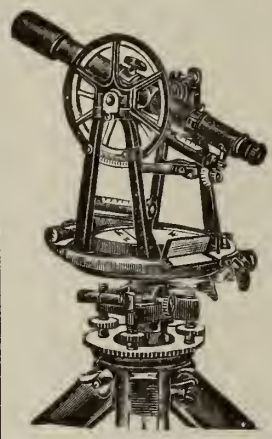
Highest Water Gauges and Largest Outputs.

All enquiries to

THE CAPELL FAN CO.

13 MOSBY ST., NEWCASTLE-ON-TYNE, ENGLAND

¶ *Complete Bound Copies for 1913 Canadian Mining Journal, with Index, are now ready. Price $4.00 per volume. Canadian Mining Journal, 44-46 Lombard Street, Toronto.*



C. L. BERGER & SONS

37 Williams Street

BOSTON, - MASS.

SPECIALTIES:

Standard Instruments and Appliances for Mining, Subway, Sewer and Tunnel, and all kinds of Underground work.

SEND FOR CATALOGUE

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work. Complete Outfits in Alberta and British Columbia.

Write for Prices.

AGENCY:—

528 Pender St. West,
VANCOUVER, B. C.

Back or Current Numbers

of any American or Foreign technical or trade Journal furnished on short notice at moderate rates; also newspapers and magazines. Government and State Reports of all kinds in stock. Clippings on special subjects furnished promptly. Magazines and papers of all kinds bought.

Special subscription price list on request.

A. W. Castellanos

263 Armstrong Avenue
Jersey City, N.J., U.S.A.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.

745 First National Bank Building, CHICAGO, U.S.A.

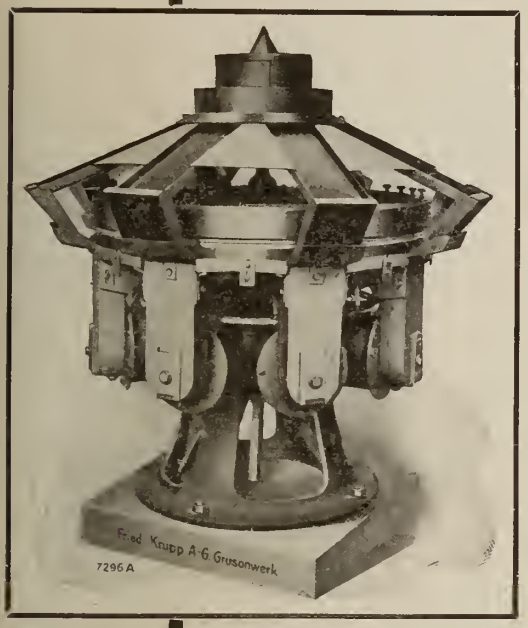
DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

"ULLRICH"
PATENT ELECTRO MAGNETIC WET & DRY SEPARATORS



treat all Kinds of strongly and weakly magnetic ores in one operation.

Ullrich's Patent Electro Magnetic Separators

have solved the problem of treating weakly magnetic ore under wet conditions; are the only machines with adjustable magnetic field zones, thus being applicable to difficult complex ores; treat coarse ore as well as slimes; have been introduced in many mines with highly satisfactory results.

The more difficult the ore, the more conspicuous the merits of the Ullrich Separator in capacity, simplicity and actual results.

Large Experimental Works for Concentration—and Magnetic Separation Tests

FRIED. KRUPP A.-G GRUSONWERK, MADGEBURG (GERMANY)

Canadian Representatives: JAS. W. PYKE & CO., LIMITED, 232 ST. JAMES STREET, MONTREAL

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

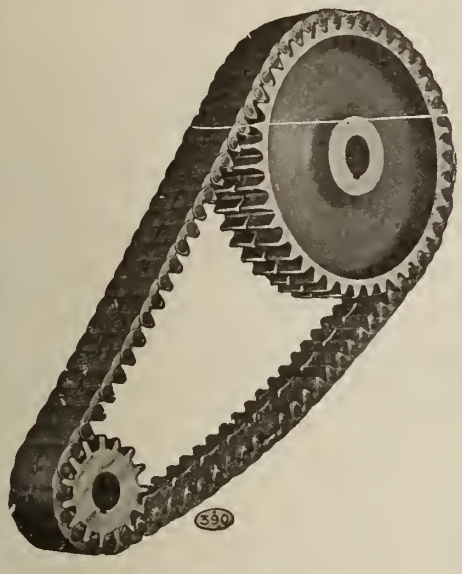
B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD (PATENT) SILENT CHAINS



Regularly applied for driving:—

Chilian Mills	Fans	Rolls
Crushers	Blowers	Stamp Mills
Deister Tables	Jigs	Lineshafts
Elevators	Pumps	Haulages, etc.

Renold Chain runs either Forward or Backward, Fast or Slow, is not affected by Heat, Cold or Moisture, and is particularly Suitable to Short Centres.

Write for Catalogue and Particulars

JONES & GLASSCO, (REG'D) Engineers

Sole Canadian Agents

Branch Office, Toronto. 49 Place D'Youville, MONTREAL

RENOLD PATENT SILENT CHAINS

Here's a type of Jeffrey Locomotive

Designed and built especially for Metal Mine Service

The feature of this locomotive is the structural steel frame.

This frame is built up of steel channels with cast steel pedestals riveted together with heavy gusset plates at the four corners. The heavy floor plate in the front and rear of the locomotive also serves to make the frames very stiff and rigid. They are much more reliable than cast frames.

Structural steel frames permit of large motor capacity for a given weight locomotive.

Jeffrey 6-Ton Locomotive for Metal Mine Work

Ball bearings on the motor permit of large motor capacity for narrow gauges common to metal mines. This type of frame is used on locomotives up to and including six tons in weight. From seven tons up the frames are made of solid steel slabs.

You can't afford to miss complete details, so write for our New Mine Locomotive Catalog No. 117.

JEFFREY MANUFACTURING COMPANY

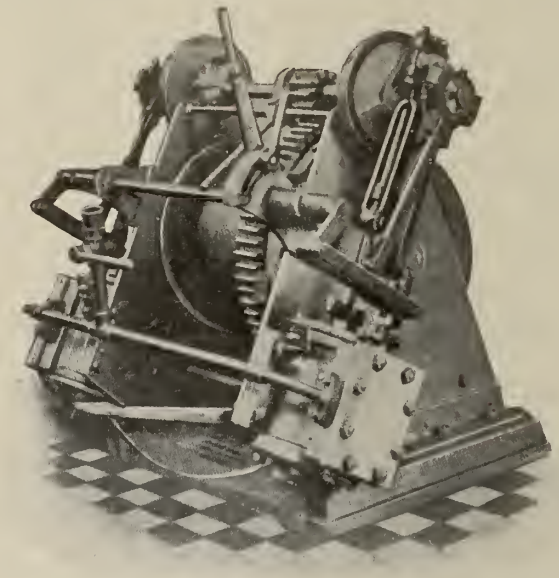
Canadian Main Office and Works : MONTREAL

HOLMAN
DIAGONAL HOISTS

AIR OR STEAM

THE HOIST FOR THE MINE

CAPACITY :
13 cwts.
21 cwts.
27 cwts.



HOLMAN DIAGONAL HOIST, Double Cylinder, Single Drum.

The Strongest and Most Compact Hoist on the market.

Designed for handling light loads under conditions where floor space is limited.

Improved Clutch Gear on the Holman Hoist does not slip, is positive in operation, engages the drum easily, and may be thoroughly relied upon even with unskilled labor.

SEND FOR CATALOGUE

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, February 1, 1914. No. 3

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - 34B Board of Trade Building
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

Editorials—	Page.
Canadian Mining Institute Headquarters	73
The Treatment of Porcupine Gold Ores	73
British Columbia in 1913	74
The Recovery of Silver from the Cobalt ores	74
Mining Gold Ore at Dome Mine	75
Treatment of Gold Ore at Dome Mine, South Porcupine, by D. L. H. Forbes	77
Monell Method of Separating Nickel and Copper Sulphides, by A. P. Coleman	85
Rock Drills, by W. L. Saunders	86
The Persistence of Gold Ore in Depth, by Malcolm Maclaren	88
The Use of Compressed Air in Cyanidation, by H. A. Megraw	92
The Treatment of Zinc Ores, by A. J. C. Nettell	94
Percentage Recovery in Ore Dressing, by E. P. Anderson.	97
Cyaniding Silver Ores at Nipissing Mine, Cobalt, by James Johnston	99
Book Reviews	102
Personal and General	102
Special Correspondence	103
Markets	108

CANADIAN MINING INSTITUTE HEADQUARTERS.

There has of late been considerable discussion, especially among Montreal and Toronto members, as to the advisability of making an effort to raise funds for the purpose of securing permanent headquarters for the Institute. It is argued that the present arrangement, whereby rooms are leased at the Windsor Hotel, Montreal, is not satisfactory and that few members make use of the rooms or library.

There seems to be an impression that members visiting the city would like to have a more attractive place, something more in the nature of a club, with club privileges. To provide and maintain such headquarters, however, a considerable sum would have to be raised.

The question now comes up as to whether the Institute is ready to incur the additional expense and the increased annual dues or other assessments which a more pretentious home would make necessary. Certainly those members who do not frequently visit the city cannot be expected to be very enthusiastic over the proposal. Many of them feel already that they get too little return for their money. If the city members wish, therefore, to add to the expenditures it is only fair that they should bear the whole burden. The city members realize this and the plans so far talked of are based chiefly on the expectation that wealthy members are ready to make donations for the purpose.

Recently the Montreal branch has had under serious consideration a proposal to raise funds for the purpose of securing headquarters for the branch. This proposal seems to have been confused with the other one of securing quarters for the Institute, by the suggestion that subscriptions be accepted from members of the Institute who are not resident in Montreal.

Some members will doubtless object to any plan which calls for expenditure of the funds of the Institute on permanent headquarters.

TREATMENT OF GOLD ORE AT THE DOME MINE.

In this issue we reprint a paper by Mr. D. L. H. Forbes which was read at the 1913 meeting of the Canadian Mining Institute and which has just been published. In the several months which have elapsed since Mr. Forbes' paper was written important additions have been made at the mill along the lines outlined in his paper. Forty stamps have been added and the foundations for a sand leaching plant are in place. It is ex-

pected that in a few months a large increase in production will be possible.

In the mill running at present there have been no radical changes made. A coarser screen, about 4 mesh, is now used to advantage since the installation of an additional tube mill. Gradually the output has been increased until now it is over 450 tons per day.

The Dome mill was constructed under circumstances far from favorable. The Merrill Metallurgical Company was called upon to design hurriedly a plant to treat an ore of which little was known. Speed was necessary in order to take advantage of the winter roads for transportation of heavy machinery from Kelso, the nearest point on the railway. The Porcupine branch of the T. & N. O. Ry. had not then been constructed.

Fire destroyed the plant under construction and again a hurry order was sent in for a complete plant.

The mill was not one specially designed for Porcupine ores; but rather an experimental one to be used in testing the ore bodies and in determining the best method of treating the ores. Naturally, therefore, the results at first obtained were not as satisfactory as those obtained later. A great deal of information has been gathered by the metallurgists in charge of the investigations, and some of this information is given in Mr. Forbes' paper.

During the past year the mill has been giving better and better results and is now treating about 450 tons per day and making a very high recovery of the gold contained in the ore.

The Dome Mines Company in enlarging its plant is undertaking still further important investigations. While the present plant is now giving what might be considered fairly satisfactory results, it is thought that still better results can be obtained by separating the sands for treatment without regrinding. Every effort is being made to determine the best method of treating the ore. The men who have done the work, the staff of the Dome Mining Company and the staff of the Merrill Metallurgical Company, deserve much credit for their contributions to our knowledge of Ontario gold deposits and methods of treating the ores.

BRITISH COLUMBIA IN 1913.

The British Columbia Bureau of Mines has published a preliminary review and estimate of the mineral production of the province for the past year, together with some notes on the progress made in the mining and metallurgical industries.

The prompt appearance of the bulletin is creditable to the Bureau and to the Provincial Mineralogist, Mr. Wm. Fleet Robertson.

The estimated production is as follows: Gold, 266,547 oz.; silver, 3,569,642 oz.; lead, 54,205,594 lb.; copper, 46,042,379 lb.; zinc, 7,100,000 lb.; coal, 2,136,694 tons (2,240 lb.); coke, 285,123 tons.

In general, the report agrees with the earlier summary of our correspondent, Mr. E. Jacobs, which was published in our January 15 issue. It contains also considerable additional information, some of which will be found in this issue of the Journal.

The total value of the 1913 production was $30,158,793, as against $32,440,800 in 1912. Copper and coal outputs were considerably smaller than in the previous year. Gold, silver, lead and zinc show an increase.

THE RECOVERY OF SILVER FROM COBALT ORES.

Remarkable progress has been made in the treatment of the silver ores of the Cobalt district. Previous to the discovery of the phenomenal silver deposits in Northern Ontario no ores of this type were being mined on this continent, and little was known of the methods of treating the similar ores mined in Germany.

The ores consist chiefly of native silver, associated with arsenides of cobalt and nickel. The gangue mineral is chiefly calcite. Silver sulphides and antimonides occur also, although in much smaller quantity than the native silver.

Fortunately much of the ore is so rich that large profits were made by simply roasting the ores to drive off the arsenic, and then smelting the product, and refining the base bullion. When the deposits were first opened cobalt and arsenic commanded good prices and the marketing of these constituents helped to defray the cost of recovering the silver. The price soon fell, however, when large quantities were produced.

High grade ore was for some time the only marketable product of the mines, if we except a comparatively small amount of low grade used by some of the smelters.

Soon, however, the lower grade material was investigated carefully and in a few years several mills were erected to crush and concentrate the ore. Straight concentration methods proved very satisfactory and a high recovery was, and is, obtained by the millmen at Cobalt.

Then cyanidation and amalgamation were successfully introduced, and some very remarkable and entirely new methods of treatment were worked out. To the staff of the Nipissing Mining Company and to its consulting metallurgists belongs the credit for many of the more recent marked advances in methods of treating both high and low grade ores.

In this issue we publish a few pages from a very interesting description of the mill and metallurgical methods of the Nipissing mine, by James Johnston. Mr. Johnston's paper was prepared for the annual meeting of the American Institute of Mining Engineers and has been published in the January bulletin. Mr. Johnston is to present a paper on the same subject at the annual meeting of the Canadian Mining Institute in March. The author describes carefully the construction and equipment of the mill and the methods of treating the ores. The costs for several operations and the results obtained are clearly stated. The paper should prove to be one of the most interesting ones presented at the annual meeting.

MINING GOLD ORE AT DOME MINE

View Across Open Pits Towards No. 2 Shaft, Dome Mine.

Good progress is being made at the Dome mine. The ore bodies are being now developed by drifts and crosscuts at the 425 ft. level. Openings have been made underground to permit of a large proportion of the ore being mined there when extreme weather conditions prevail. Nearly all of the ore milled so far has been broken in the open pits. The preparations now made will permit of the discontinuance of work in the open when the weather is very severe.

The men working in the open break a very large tonnage in an 8-hour shift. The practice is to have the miners work one shift per day only. The blasting is done at night. The blasters use one machine to drill the large blocks.

Rand hammer drills, one man machines, are used for this work in the pits. Underground the Ingersoll-Rand No. 43 piston drill is used in crosscuts and drifts. In raises Rand Butterfly stoper drills are used.

Miners Working in one of the Open Pits, Dome Mine.

During the first three months of 1913 there was broken in stoping 43.7 tons per machine-shift. The Rand No. 43 drills averaged 30 ft. per machine-shift, and the Rand hand hammer drills averaged 38.7 ft. per machine-shift. The more recent records show a considerably higher tonnage per machine. For the deeper ore the main hoisting way is to be the No. 2 shaft, a vertical one. The ore from the open pits is now being hoisted up an incline shaft directly to the crushers.

Miners Working in one of the Open Pits, Dome Mine.

It is the intention to avoid the surface tramming of ore by putting in an ore bin at the 100 ft. level of No. 2 shaft. From the lower workings the ore will be raised and delivered to this bin. It will then be run into cars which will be drawn to the incline shaft by mules. These cars will be hauled by engine up into the crusher house as at present.

CANADIAN MINING INSTITUTE ANNUAL MEETING.

The Sixteenth Annual Meeting will be held in the City of Montreal on Wednesday, Thursday, and Friday, March 4th, 5th, and 6th, 1914.

The Institute's headquarters will be the Windsor Hotel. Applications for accommodation should be made through the Secretary of the Institute, or direct to the manager of the Windsor Hotel.

Among the papers already promised for the meeting are the following:

"Mill and Metallurgical Practice at the Nipissing Mining Company, Cobalt, Ont.," by James Johnston, Cobalt, Ont.; "The Sampling of Cobalt Ores," by C. St. G. Campbell, Cobalt, Ont.; "The Veins of Cobalt District, Ont.," by Arthur A. Cole, Cobalt Ont.; "Recent Improvements in Cyanidation," by Herbert A. Megraw, New York; '"Some Notes on Mining and Milling Practice at the Alaska Treadwell Mine," by H. C. Meek, South Porcupine, Ont.; "Ore Dressing Improvements," by Robert H. Richards, Boston, Mass.; "Recent Metallurgical Developments," by A. Stansfield, Montreal, Que.; "Methods of Excavation in the Mount Royal Tunnel," by S. P. Brown, Montreal, Que.; "Factors Influencing the Cost of Power for Mining Purposes," by J. M. Forbes, Montreal, Que.; "High Carbon Steel for Sluice Linings in Hydraulic Mining," by Howard W. Dubois, Philadelphia, Pa.; "Mining in British Columbia" (illustrated by colored lantern slides), by Howard W. Dubois, Philadelphia, Pa.; "Scientific Management," by F. G. Gilbreth, New York; "Efficiency Engineering Applied to Mining, Quarries, and Industrial Plants," by H. M. Payne, New York; "The Chisana Gold Field," by D. D. Cairnes, Ottawa, Ont.; "Coal Resources of the World," by D. B. Dowling, Ottawa, Ont.; "Asbestos Resources of the Thetford Area," by W. J. Woolsey, Thetford Mines, Que.; "Safety in Coal Mines" (illustrated by moving pictures), by a representative of the H. C. Frick Coke Company, Pittsburgh, Pa.

CORRESPONDENCE

Editor Canadian Mining Journal:

Sir.—In a recent issue of your valued paper appeared an item headed "Oxygen Breathing Apparatus," in which item Mr. F. W. Gray, of the Dominion Coal Company, has been given just credit for work he has done in connection with the development of the use of rescue apparatus in this country.

But you state. "He was the first person on this continent to bring over a rescue apparatus of the oxygen type." This statement is at variance with the facts, and if there is any special honor attached to the person having first introduced such an apparatus into Canada, that credit is due to Mr. R. H. Brown, mining engineer, of Halifax, N.S.

Mr. Brown, in the year 1895, while general manager and agent for the General Mining Association, imported a Siebe Gorman type of oxygen rescue apparatus for emergency use in the coal mines then operated by that company.

This apparatus was in the possession of the General Mining Association, and of their successors, the Nova Scotia Steel & Coal Company, Ltd., up to this year.

You will notice that the date of the use of the oxygen type of rescue apparatus antedates by a good many years the arrival of Mr. Gray in this country.

While I am anxious that any person who does anything that is of benefit to the mining interest or fraternity of the province or the Dominion, should receive due credit for same, and while I am not desirous of disparaging Mr. Gray's efforts in this line, having the above knowledge. I feel it is my duty to give the credit to whom the credit is due. There is not the slightest doubt but that Mr. Brown and his officers were quite familiar with and had in use the oxygen rescue apparatus type of machine quite a number of years previous to its coming into general use.

Yours,

THOS. J. BROWN,

General Superintendent N.S. Steel & Coal Co., Ltd.

TREATMENT OF GOLD ORE AT DOME MINE, SOUTH PORCUPINE, ONTARIO*

By D. L. H. Forbes.

Late in the fall of 1910 it was decided to erect a mill at the Dome mine. The Porcupine branch of the Timiskaming & Northern Ontario Railway had not then been built, so that supplies and machinery had to be transported in winter over rough roads from Kelso. It was a matter of the utmost importance to the Dome Mines Company that the mill should be designed without delay, to insure that all material and machinery for construction could be ordered in time to reach Kelso before the breaking up of the winter roads. Two separate samples of Dome ore were sent to San Francisco for testing; but, as these samples were taken from the mine in its early stages of development and differed considerably in value, the design of the mill had to be of the most flexible nature, to provide for a high extraction even if future development of the mine should disclose ore of different character to that tested.

It was originally planned that the building should be a wooden structure, but after the disastrous fire in the summer of 1911, when the work of construction was already well under way, a change was made to steel construction, thus ensuring a fire-proof building.

In spite of delay caused by the fire, the mill was completed in record time and placed in operation on March 22, 1912. Acting for the Merrill Metallurgical Company, Mr. Henry Hanson supervised the installation. To his energy and ability in overcoming the many obstacles incidental to construction work in a new mining camp, the success achieved was, in a large measure, due.

The Dome ore consists of quartz and schisted slate that has been sheared and metamorphozed to such an extent as to be scarcely distinguishable, except in toughness, from the darker colored schists of the Pearl Lake section of the district. Both the quartz and the slate have been heavily mineralized with pyrite so that the ore is heavier than most quartz gold ores, its specific gravity averaging about 2.8. The ore is reduced under stamps and in tube mills to a granular slime with the production of relatively only a small proportion of colloids, giving a material that is almost ideal for settling and pressure filtration in the cyaniding part of the treatment. While some of the gold is coarse, no large nuggets have been found in the mortars of the stamp batteries, and, in general, a considerable proportion of the gold occurs in such fine particles that tube mill grinding is necessary for its liberation preparatory to either plate amalgamation or cyanide treatment.

In order to be prepared for an acid ore which might come from the lower workings of the mine, as well as to insure efficient amalgamation, with the consequent quick and complete cyanidation of the amalgamation tailings, it was decided to crush and amalgamate in water. This provides against an excessive consumption of cyanide in the cyanide treatment, and also safeguards against losses due to the presence of coarse gold.

Filling Stamp-Mill Bins with the Crushed Ore, Dome Mill

The mill as first designed was considered a testing unit of a daily capacity of 350 tons to prove the economic value of the ore in the mine, and to indicate the best metallurgical treatment for future adoption, when additions to the milling plant would be required. Regarded as a large experimental mill for Porcupine ores, the results of the operations to date are interesting. It is the purpose of this paper to present a general outline of the plant, and to refer to the results of its operations from the technical rather than from the economic aspect, as many factors, such as power, water supply, and ore tonnage, which affect operating costs, have been of a temporary nature; hence costs based on such conditions might be misleading.

*A paper read at Annual Meeting of C. M. I., 1913.

Crushing.

Preliminary crushing of the ore is done in Kennedy gyratory breakers. The open cut system of mining produces much ore that is over thirty inches in size. To handle such large lumps of ore a crusher with a wide jaw opening is required. A No. 7½ breaker takes the ore dropped from the mine cars and crushes it through an opening of about 6 inches. The broken ore is then elevated by a belt conveyor and screened over a grizzly having 1½ inch openings, from which the oversize goes to two No. 3 crushers. The secondary crushers reduce the ore to a size of 1½ inches, dropping it on a second inclined belt conveyor, where it joins the undersize from the grizzly and is delivered to the stamp mill bin. The crusher plant and conveyors are housed in a wooden building, which is divided from the main steel building of the mill by a fireproof door and partition. The ore is distributed along the top of the battery bin by means of a third belt conveyor, provided with an automatic tripper. The battery bin is of steel construction throughout, is flat-bottomed and has a capacity of about 1,600 tons.

View of Stamp-Mill Bins, Dome Mill. Shows Conveyor and Distributing Apparatus

Stamp Milling.

From the bin the ore is fed to four ten-stamp batteries by means of suspended Challenge feeders. The stamps weigh 1,250 pounds. There are independent battery line shafts behind the stamps, one for each 20 stamps driven by a 75 h.p. motor placed behind the ore bin on the ground level. The stamps make one hundred and two 6½-inch drops per minute, and crush through ten-mesh, rolled, slotted, wire screens. Several screens of different mesh have been used since the plant was started. The following table gives the average results in stamp duty and size of product when using the various mesh sizes:—

Effect of Screen Opening on Stamp Duty and Product.

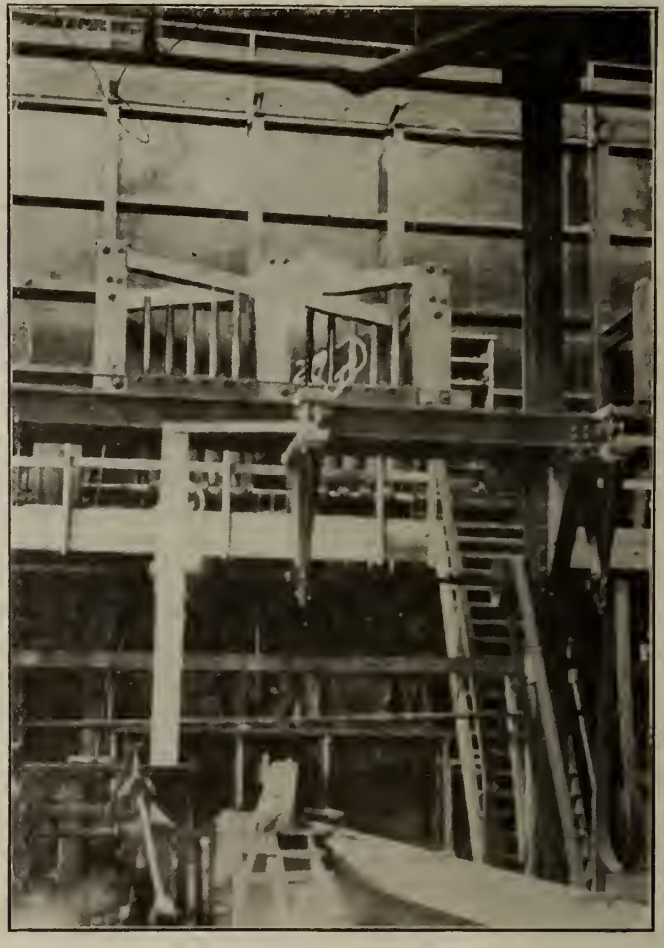
Battery Screen Used	Stamp Duty. Tons per Stamp per Day.	Screen Tests on Battery Discharge.			
		On 60-mesh %	On 100-mesh %	On 200-mesh %	Through 200-mesh %
16-mesh	6.8	41.6	8.8	10.4	38.8
14-mesh	7.9	62.0	6.4	6.8	24.8
12-mesh	9.0	64.0	7.0	6.0	22.8
10-mesh	9.6	59.0	15.0	7.0	19.0

Crushing through 10-mesh screens the stamps give the most economical results. About 7.5 tons of water are fed to the batteries for every ton of ore stamped.

Primary Plates Discarded.—When the mill was started there were eight primary amalgamating plates, one in front of every five stamps, each being 54″ x 144″ in size with a slope of 1½ inches per foot. It was found when the pulp was passing through 16-mesh screens the primary plates caught more gold than the secondary ones, which follow the tube mills. With 14-mesh screens the amount of gold caught on the primary plates was only slightly greater than that caught on the others, while with 12-mesh screens the secondary plates recovered more of the gold than the primary plates. When 10-mesh screens are used the primary plates recover very little gold and are difficult to keep properly dressed, owing to the scouring action of the coarse sand, hence the primary plates were removed after it was decided to aim at large crushing capacity per stamp.

The relation of the mesh of the screens used on the batteries to the recovery by amalgamation was found to be about as follows:

Using 16-mesh screens, the total recovery by amalgamation was 78 per cent.



View from Front of Batteries, Dome Mill. Note absence of Primary Plates.

Using 14-mesh screens, the total recovery by amalgamation was 75 per cent.

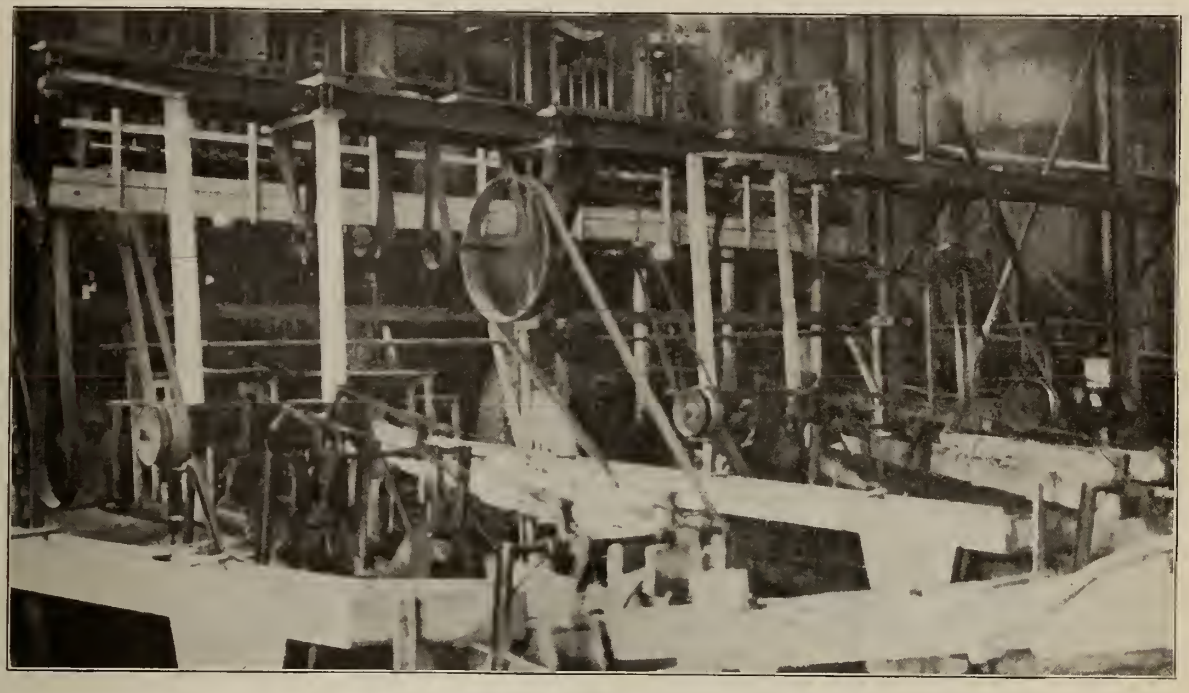
Using 12-mesh screens, the total recovery by amalgamation was 55 per cent.

Using 10-mesh screens, the total recovery by amalgamation was 46 to 50 per cent.

At the time when the highest recovery by amalga-

mation was obtained the stamps were giving a duty of only 6.8 tons per day, and the slime treated by the secondary plates was of such a fineness that 85 per cent. would pass a 200-mesh screen.

The lowest recoveries by amalgamation were noted over periods in which the stamp duty was at a maximum, and only 65 per cent. of the slime treated on the secondary plates would pass a 200-mesh screen.

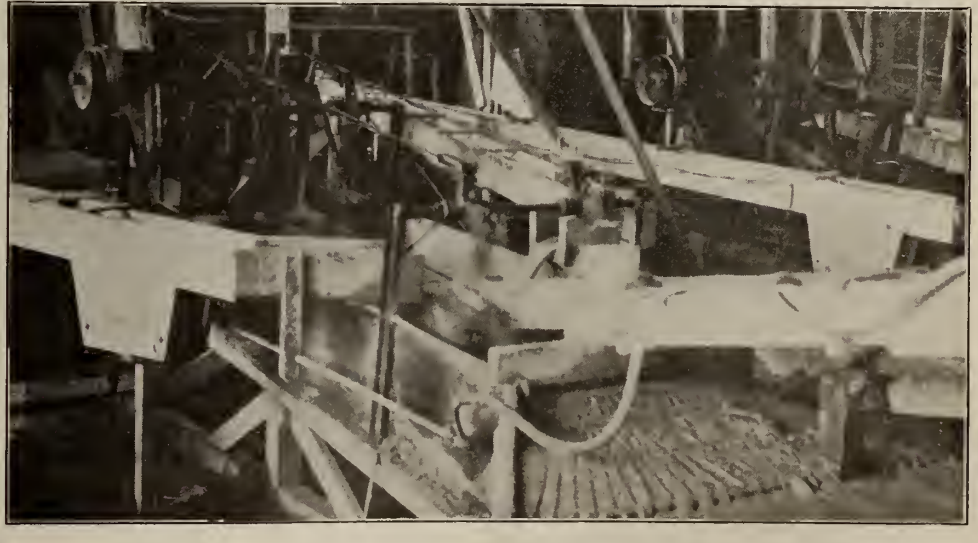


View of Classifiers and Stamps. Dome Mill.

Classification and Tube Milling.

Classification.—The pulp discharged from the batteries goes to four duplex Dorr classifiers, the sand product of which passes to four 5′ x 22′ tube mills. The slime product of the classifiers is carried over four secondary amalgamating plates, one for each classifier. These plates are 108″ x 144″ in size and have a slope of about 1½ inches per foot. After leaving the plates, the slime is passed through sets of Merrill concentrating cones which trap the coarse concentrate and any amalgam or coarse gold that may have escaped from the secondary plates, the coarse concentrate is then returned to the tube mills.

The tube mills are run at 26 to 28 r.p.m. by slip-ring motors coupled direct to the tube mill pinion shafts. Each mill takes approximately 70 h.p. The linings used are of the El Oro type made of chilled cast iron. The discharge of each tube mill is elevated, and returned to the corresponding classifier on the floor above it by means of an 8″ x 40″ Frenier sand pump. When the fineness of the slime is such that 75 per cent. will pass a 200-mesh screen, it has been found that the most economical results are obtained taking into consideration both the total recovery of the gold and the milling cost per ton of ore treated.



View of Dorr Classifier, Dome Mill. Note Slime Overflow Running onto Amalgamating Plate.

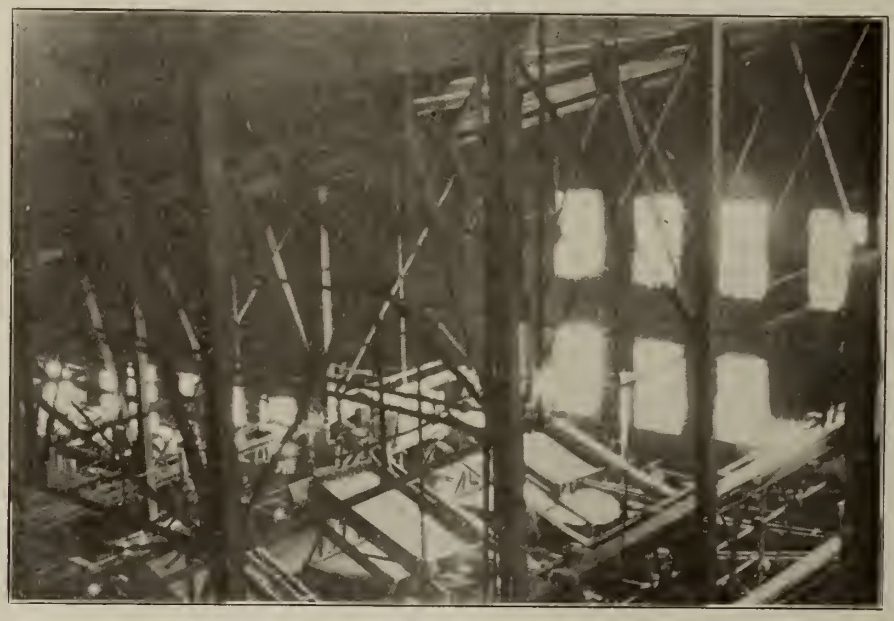
Thickening.—The slime is at a dilution of about 10 tons of water to one ton of solids. The water is re-

moved as completely as practicable by settling the slime in three 30′ by 10′ Dorr thickeners, before cyanide treatment is commenced. The thickened slime discharged from these tanks contains about 44 per cent. of moisture. The overflow from the thickeners is usually quite clear, and is collected in 20′ x 10′ storage tanks, from which it is repumped to the tank above the batteries by a triplex plunger pump.

ore. The squeezed amalgam taken from these plates carries about $5.50 in gold per oz. The consumption of mercury varies from 0.9 oz. to 1.6 oz. per ton of ore treated.

Cyanide Treatment.

Consumption of Cyanide.—The slime discharged from the Dorr thickeners is ready for cyaniding and



View from above the Stamps, Dome Mill. Shows the Secondary Amalgamating Plates.

Lime is added to the battery water circuit in sufficient quantities to give good settling results in the thickeners, and also to neutralize any latent acidity in the ore. The total consumption of lime averages about 3.2 pounds per ton of ore, and, of this quantity, the larger proportion is used in the battery circuit.

Recovery on Plates.—As might be expected, a certain amount of coarse gold collects with concentrate on the classifier bottoms and remains in the tube mill circuit until ground fine enough to overflow with the slime over the secondary amalgamating plates. These plates, under present practice (January, 1913), recover from 46 to 50 per cent. of the total gold in the

is elevated to the treatment tanks by a duplex set of 16-inch bucket elevators which are 70 feet in height between the centres of the pulleys. Cakes of potassium cyanide are dissolved by the pulp as it enters the bottom of the elevators and sufficient cyanide is added to give a treatment solution of about 1 lb. KCN per ton. The average consumption of cyanide

Merrill Slime Filter Press. Dome Mill.

varies from month to month between the limits of 0.8 lb. to 1.1 lb. KCN per ton of ore treated. The greater part of this consumption is the mechanical loss due to displacement of weak solution by the water coming in with the slime from the thickeners.

Pachuca Tanks.—The method of treatment in use

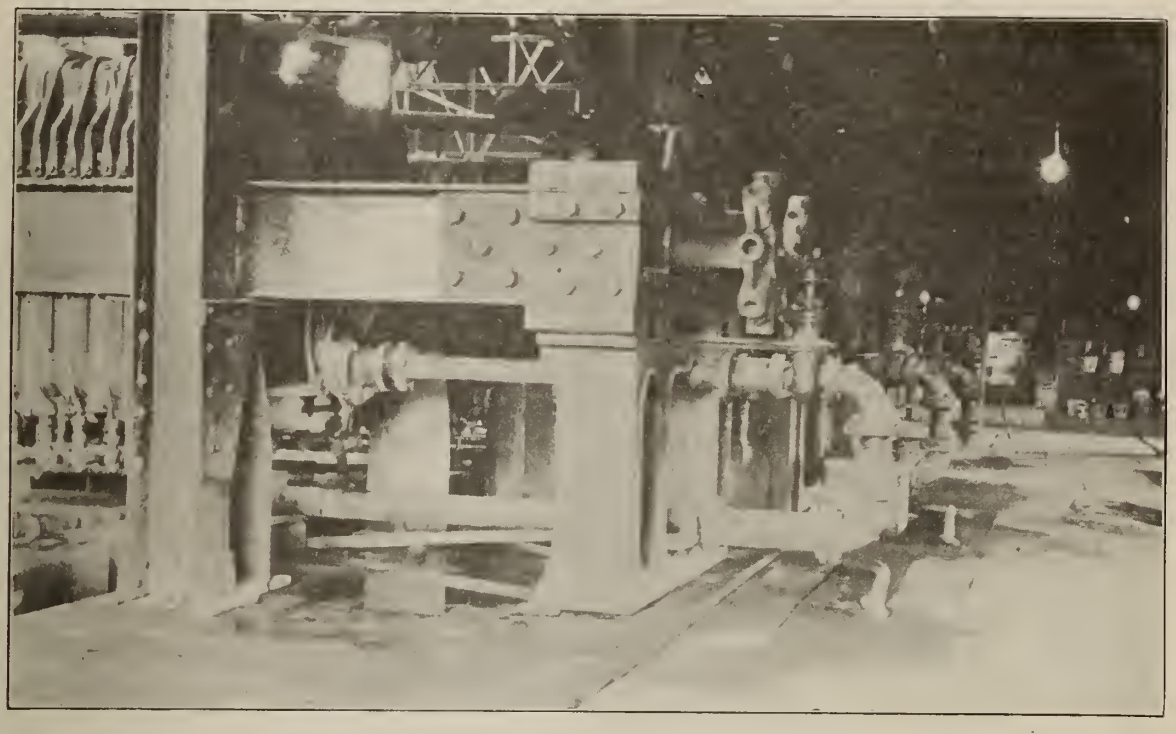
is that of air agitation by the continuous Pachuca tank system. There are four tanks, 8 feet in diameter by 40 feet in height. The air for agitating the slime in these tanks is compressed to 20 lb. per square inch at the receiver by a 14″ x 16″ single stage, belt driven Rand compressor which is driven at about 240 r.p.m.

From the final treatment tank, the slime is run to a storage tank in which it is mechanically agitated and drawn off intermittently to the filter presses.

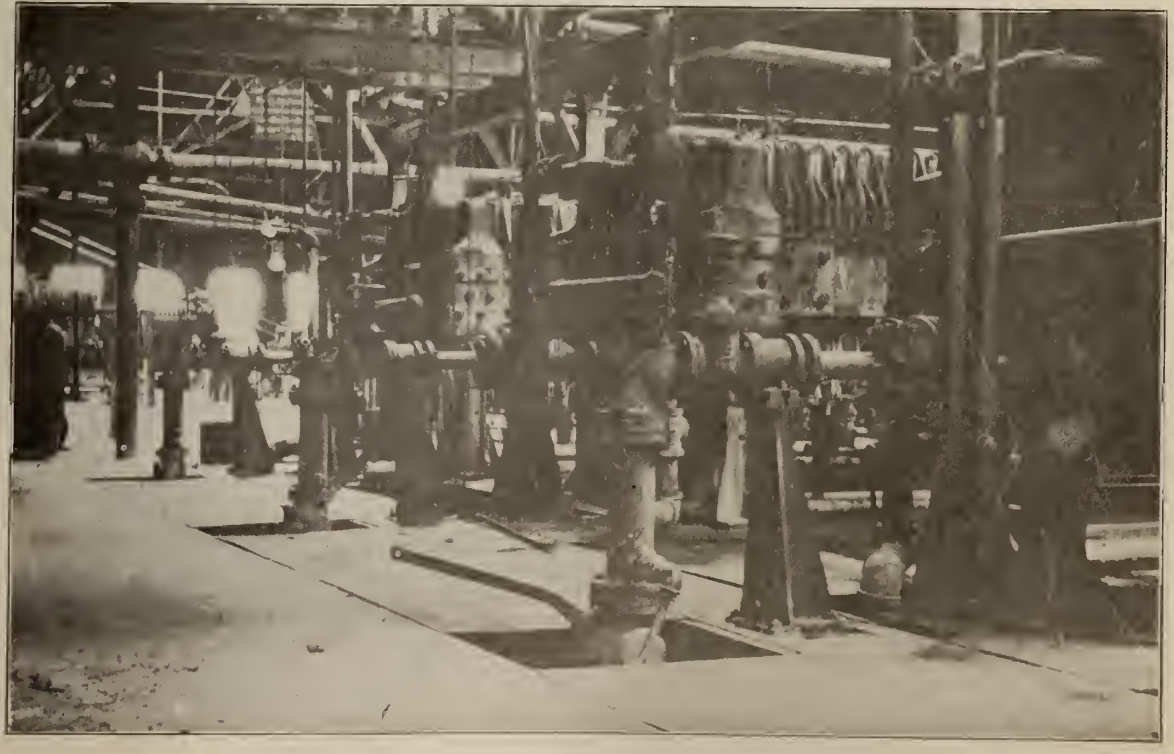
Filtration.

Merrill Presses.—Two Merrill slime filter presses, each having 75 4-in. frames filter the treated slime. At each charging of a press about 20 tons of slime is drawn from the storage tanks at a dilution of 1 to 1, the filling of the presses occupying from 22 to 30 minutes, until the four-in. frames are filled with solid cakes of slime at a final pressure of 20 lb. per square inch.

Washing.—Precipitated solution is then forced

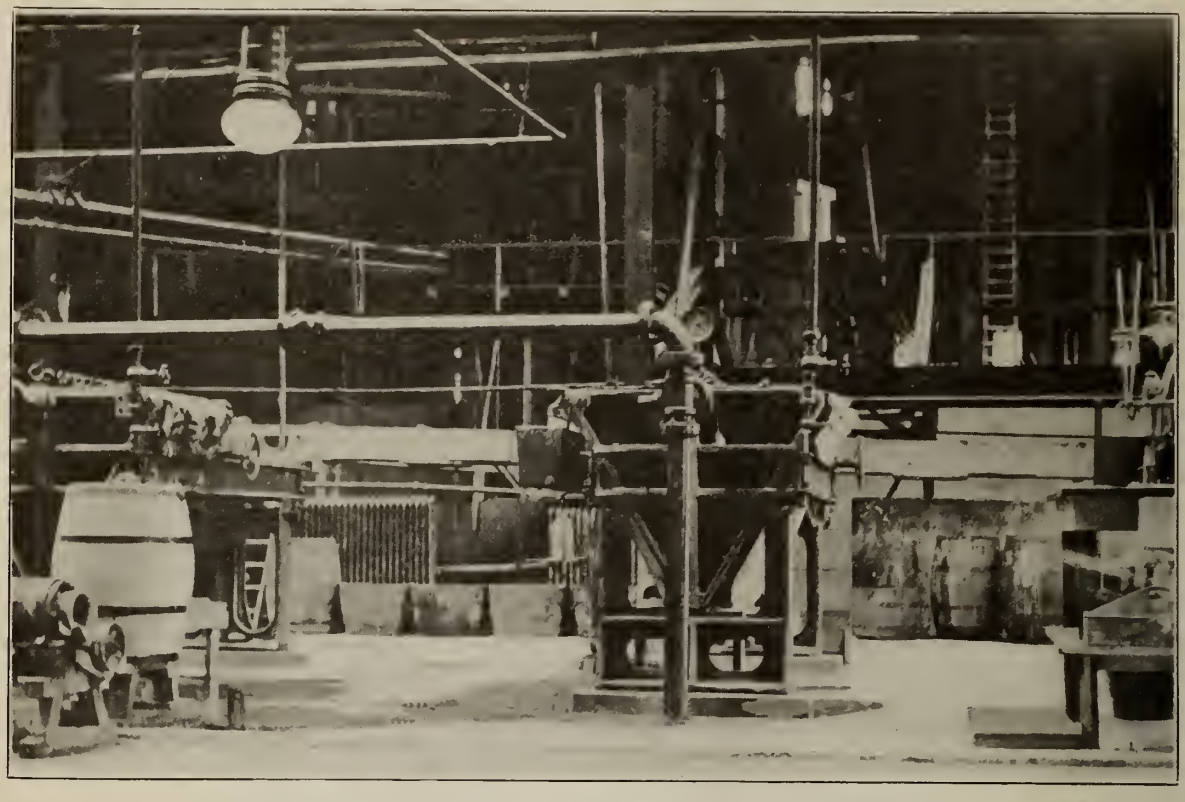


Merrill Slime Filter Presses—Rear Ends. Dome Mill.

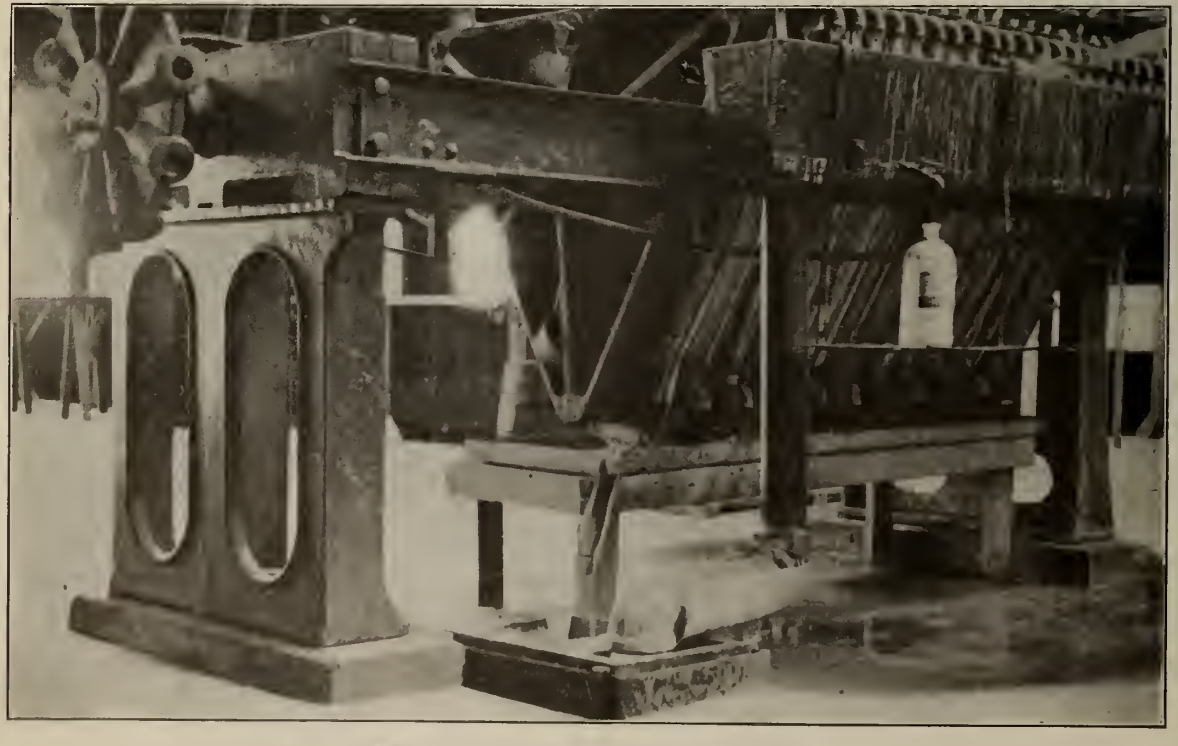


Merrill Slime Filter Presses—Head Ends. Dome Mill.

through the cakes of slime for washing out the dissolved gold remaining in the cakes. During this washing period it has been noticed that a perceptible extraction of undissolved gold takes place. The time allowed for washing is determined by the operators who measure the rate of the solution passing through the presses, so that approximately one ton of wash solution will be passed for every ton of dry slime in the charge. After washing is complete, the discharge valves are opened, and then the mechanism for sluicing out the residues is started. The time required for discharging a press is usually about 50 minutes. The residues discharged from the filter presses with the sluicing water are collected in two 25′ x 10′ Dorr slime thickening tanks, in which the excess water used for sluicing is recovered while the thickened slime residues, at a consistency of about 2 of water to 1 of solids, are allowed to run out to waste.



One of two Merrill 52 in. Precipitating Presses. Dome Mill.



Merrill Precipitating Press. Dome Mill.

Precipitation.

Zinc Dust Used.—The cyanide solution in which the gold has been dissolved flows from the Merrill slime presses in so clear a condition that no clarification is necessary before precipitation. The gold carried by this pregnant solution varies from $2.50 to $6.00 per ton of solution. This gold is precipitated from the solution and recovered in filter presses by the Merrill zinc dust precipitation process. An emulsion of zinc fume and cyanide solution, prepared in a miniature tube mill, is fed in definite amount at a uniform rate to the pregnant solution at the suction side of the Aldrich triplex plunger pumps; these force the solution through precipitation presses in which the gold is trapped in the form of a black mud that has a value of about $40.00 per lb. Two triangular frame 52-in. Merrill precipitation presses are used. One has twenty frames while the other has ten frames—the frames of both presses being 2 inches in thickness. The cyanide solution flowing from the presses carries from a trace to 8 cents in gold, and is returned to the top of the mill for use in washing dissolved gold from the slime filter charges. A certain amount of solution has to be run out to waste from time to time: this solution is carefully precipitated so that its value may not exceed 3 cents per ton. The amount of this solution run to waste is the difference between the number of tons of water entering the system at the treatment tanks with the unthickened slime, and the number of tons of solution retained by the cakes of treated slime that are discharged from the filter presses.

In precipitating gold solutions with zinc dust, more zinc is used immediately after the clean-up of precipitate from a press than at any other time, regardless of the grade of pregnant solution to be treated. The practice at the Dome mill is to feed the zinc dust as follows:

For the first hour after a clean-up, ¾ lb. per ton of solution; for balance of first day after clean-up, ¼ lb. per ton; for second day after clean-up, 1.5 lb. per ton of solution; for third day and until following clean-up, 1.6 lb. per ton of solution.

The average consumption of zinc per ton of ore treated is about 0.37 lb.

Melting Gold Precipitate and Retorting Amalgam.

A separate building, made of brick and situated behind the mill, is used for the melting room and assay offices. The melting room contains an amalgam retort, an acid treatment tank, a briquetting press, a lead smelting furnace, cupel furnace, a tilting oil-fired melting furnace, and a clean-up barrel for pulverizing litharge and cupel bottoms.

The gold from retorted amalgam is melted in the tilting furnace into bars of 990 to 995 total fineness, 890 of which is gold and about 100 silver. The melting of retort gold is done twice every month.

The precipitate, after being acid-treated to remove the large excess of zinc, is dried and then mixed with litharge, borax cake, and a small amount of fuel oil for binding the materials together when the mixture is pressed into briquettes. These briquettes are smelted in the lead furnace and the resulting lead cupelled. The slag, which assays from $40 to $100 to the ton, is re-melted in a later so-called "scavenger" run, together with cupel crusts and scrap metal, during which the slag tapped from the furnace carries only about $3.00 per ton in gold.

The cupel is oil-fired and has a bottom made of a mixture of one part Portland cement with three parts crushed limestone. The operation of cupelling is carried to the point at which about 25 one-thousandths of lead still remain with the precious metals. At this point the metal is brittle when cold, and may be easily broken into pieces for charging the tilting furnace, which melts the gold into bars for shipment. If cupelled beyond this point, however, the gold is tough and has to be divided into sections of convenient size, while molten, by means of iron dividing strips.

Without treating the precipitate by sulphuric acid before smelting, bullion of 900 to 950 fineness is produced, but, as the New York assay office objects to the presence of even 40 one-thousandths of zinc in the bullion, the acid treatment was rendered necessary and it is found that its cost is fully offset by the saving in fluxes and fuel, while the fineness of the bullion can be raised to 990.

Sampling and Weighing.

Daily samples are taken in the mill at the following points: (1) The broken ore delivered to the battery bin; (2) the pulp discharged from the batteries which is called the lip sample; (3) the slime leaving the amalgamation plates which is called "amalgamation tailings" sample; (4) the residues after filter pressing; (5) the sluicing water sent to waste with the residues; (6) the pregnant and barren solutions.

The average assay of the ore delivered to the mill during any month is calculated by dividing the sum of all the gold recovered in the plant, plus the gold lost in residues and sluicing water, by the tonnage treated during the month. The computed average is found to check reasonably well with the average of the battery lip samples but is usually quite at variance with the average of the broken ore samples.

The estimation of weight is calculated each day from a series of hourly measurements made on the flow of slime from the tube mill circuit to the slime thickening tanks. The entire flow of slime is diverted into a small steel measuring tank. The time interval is taken with a stop watch; the volume of the slime collected during this period is accurately measured and samples are carefully taken for the determination of the "solid to liquid ratio" before the slime has had any chance to settle. From these determinations a calculation, simplified by reduction to a formula in which the constants used have been incorporated, gives the rate of flow in tons of dry ore per day. Since this measurement deals with the tonnage of dilute slime, that is ten times the tonnage of dry ore being milled, errors of measurement are divided by ten when dry ore tonnage is deduced from it.

It may seem strange that after a careful consideration of the different methods and apparatus for weighing ore, such a one as the above should have been adopted at the Dome. However, a little consideration of the conditons here shows how unreliable would be the ordinary methods of weighing. Ore coming from the open cuts and delivered in cars to the crushing plant often contains from 5 to 8 per cent. of moisture, and car weights, even when corrected for moisture by taking a moisture sample, would be only as accurate as the number of tons of water estimated to be with the ore, while it is almost impossible to obtain such a moisture sample with any degree of accuracy. The same objection applies to the continuous automatic weighing devices of the Blake-Dennison type, in which

a further source of error may be introduced by wet ore sticking to the conveyor belt. With proper care at each observation, the time-volume, specific-gravity determination of weight gives results in which the probable error is less than would occur when weighing wet ore, on either platform or belt conveyor scales, in cases where a large correction for moisture has to be made.

General Conclusions.

The metallurgical extraction obtained on ore of ½-oz. grade is found to be over 95 per cent., of which approximately one-half is made by amalgamation under the present conditions of tube milling and stamping through 10-mesh screens.

Judged by the experience at the Dome it would seem that on low-grade Porcupine gold ore, even when tube mill grinding follows stamping, the recovery by amalgamation alone cannot be carried much above 75 per cent.

The cyanide process is admirably adapted for obtaining a high recovery at low operating cost. It still remains to be determined, however, whether or not the cheaper cost of operating a partial sand-leaching cyanide plant would not offset the additional extraction obtained by reducing all of the ore to slime in tube mills, and then filter-pressing the treated slime so produced. Experiments along these lines are now being conducted in conjunction with experiments to determine the feasibility of leaching slime in the Merrill filter presses, as is done at the Homestake mine where exceptionally low-grade ore can be profitably treated, by reason of the cheapness of operation and the high recovery obtained.

Discussion.

Mr. H. A. Megraw: (Communication to the Secretary:)—Mr. D. L. H. Forbes' paper treating of the mill and process in use at the Dome mine, is an interesting addition to technical knowledge.

The matter of an adequate sampling and weighing system has not, to my knowledge, received any especial treatment at the Dome mill. This was one of the points to which I have called attention, and as I have devoted a special paper to the subject in general, it will not be necessary to go into detailed argument at this time. Evidently it has received the consideration of the Dome operators, as they are not likely to have overlooked so important a detail. It is probable that it is not considered economical to attempt exact sampling, the tailing assay from the filter presses showing the amount of loss and the exact percentage of recovery not being considered essential. Stamp crushing followed by regrinding in tube mills, is the standard system used at the Dome mill, the only distinguishing feature being that the crushing and regrinding is carried out in water, while at most modern all-sliming mills it is done in solution to avoid the loss involved in changing from water to cyanide solution. The compelling reason in the case of the Dome is the necessity of using plate amalgamation for recovering as great a percentage of gold as possible before beginning cyanidation. The water crushing and plate amalgamation does not seem to be entirely justified at the Dome, but of course the question can only be settled by a comparison of costs. If amalgamation is considered necessary, there would seem to be no reason why it could not be carried out as well in cyanide solution, as is done at the Liberty Bell mill, for instance; or if its primary object is the prompt recovery of coarse gold particles which would unduly delay cyanidation, one has only to consider the system in use at the Hollinger mill, treating ore of similar character, where the pulp is concentrated and the concentrate treated separately by cyanidation. Experience at the Hollinger seems to show that coarse-gold particles entering the tube mills are likely to stay there until thoroughly ground up and, most likely, dissolved. I have already mentioned the remarkable efficiency of the tube mill as a cyaniding machine, due to a combination of advantages, among which may be mentioned its receiving freshly precipitated, barren solution, which is extremely active, the grinding and agitating action and the slightly higher temperature generated by the friction within the mill. The grinding action of the pebbles and quartz sand ought to be particularly effective in abrading particles of gold. Mr. Forbes does not mention this subject in his paper, although it has doubtless been considered.

The Dome mill, while its installation was carefully considered as circumstances would permit, embodies a more or less tentative scheme of treatment. The necessity of promptness and the small amount of underground development, as explained by Mr. Forbes, account for this condition, while personal conversation with Mr. Merrill has confirmed it, he having indicated that with the information gained by the operation of the present mill, further expansion might be made the occasion for a change of the treatment system. Current information shows that the treatment is, in fact, to be substantially changed. The information at my command at this time is, unfortunately, not official or complete, but it is known that 40 additional stamps are to be installed, doubling the present stamping capacity, and that six 40 x 10 ft. leaching tanks will be put into use.

Here, then, is a most significant and far-reaching change; adopting separate treatment in place of total sliming. Hard as the Dome ore is, this seems a most reasonable and beneficial change, as the smaller recovery by leaching, if indeed it is smaller, will probably be more than offset by avoiding the regrinding to slime. It is most probable that the sand in the battery pump will be partially reground in the tube mills, again separated, and the clean sand leached. Whether more tube mills will be used, I do not know, but it seems likely that the present installation will be sufficient to reduce the increased quantity of sand to a size appropriate for leaching.

Whether or not there will be any change of the water-crushing system, does not appear at this time. In view of the fact that Mr. Merrill has secured such uniformly satisfactory results by water crushing at the Homestake, it seems likely that he would prefer to keep to that system. I have already mentioned that the use of water in the crushing system is believed, in some cases, to have advantages other than the presumed amalgamation obtained. In some Western districts, notably at Goldfield and Tonopah, operators believe that when solution is used in the crushing system, chemical combinations prejudicial to good cyanidation are formed which would be avoided were water used. These combinations are said to destroy cyanide. At Goldfield, water is used in crushing, but at Tonopah, where silver ores are treated, the loss of cyanide,

due to changing solutions and discarding excess, is believed to be greater than that destroyed when solution is used for crushing. At the Dome, however, where the ore is quite clean, one would not expect any detrimental results from solution crushing.

The very tall and narrow Pachuca tanks used at the Dome mill have always appeared to me expensive to operate, but they have been considered necessary in view of the extremely heavy nature of the pulp. With the change of treatment system, however, these tanks would seem to be made unnecessary, as only the true or natural slime will have to be agitated, the granular, sandy portion going to leaching tanks. A less expensive agitation system ought to be available under the changed conditions.

Whatever details I have discussed here are mentioned with the sole object of throwing more light upon cyanidation in general, using a well-considered, modern plant as a basis for argument. There is no room for doubt that the Dome mill has been successful in the past and will be more so in the future. Mr. Merrill and his associates are quite competent to conceive and produce a successful plant. Their handling of the metallurgy assures thoroughly practical and highly economical results.

Mr. D. L. H. Forbes: I desire to comment briefly upon Mr. Megraw's contribution to the discussion of my paper. The weighing and sampling of ore is a matter on which widely differing views are held. In all engineering measurements "Exactness" is unattainable, and it should be not so much a question of trying to obtain that which is beyond our reach as of obtaining results within limits of accuracy, yet close enough for the purpose to which the results are to be applied. It is true that there are automatic weighing machines which will weigh dry ore to within less than 1 per cent. error, but such a device is out of proportion and even inaccurate when applied to very wet ore coming from the mine. Besides the error introduced by wet ore sticking to the belt of such machines, there is an unavoidable large error in the estimate of moisture contained in the ore. There is no doubt that, in cases where ore coming from the mine is nearly dry, it is most economical and satisfactory to use either automatic continuous weighers of the Blake-Dennison type or registering car scales, but at the Dome mine conditions are such that neither of these methods was deemed advisable.

The matter of sampling ores going to the mill is also one that is a subject of much controversy. In general I am inclined to agree with Mr. Megraw's stand that it pays to sample the mill heads wherever it can be done with a reasonable degree of accuracy and without adding a heavy charge to the cost of milling. That it is possible to sample gold ores such as that of the Dome no one will deny, but an idea of the cost of obtaining results that are reliable can be gained by looking up the rates charged by customs sampling works. No manager who is not engaged in purchasing ores would care to add such heavy operating charges to his milling cost as this class of ore-sampling would involve; yet to install anything short of such methods would be wasting money when sampling ore that is lacking in uniformity of gold distribution.

Contrary to Mr. Megraw's impression, the losses of the mill used in calculating extraction are not alone those in the tailing, but every other possible source of loss is also taken into consideration and estimated as closely as practicable. All waste solution and sluicing water issuing from the mill are regularly sampled and measurements of volume taken.

Mr. Megraw is entirely right in stating that the question of water crushing as compared with crushing in solution is one that can only be settled by a comparison of costs. It is precisely on this basis in combination with the total recovery of gold that the argument for the Dome mill practice rests.

MONELL METHOD OF SEPARATING NICKEL AND COPPER SULPHIDES

In specification of Letters Patent Mr. Ambrose Monell, president of the International Nickel Co., describes the method of separating nickel and copper sulphides.

In the reduction of ores containing nickel and copper where a matte is produced containing sulphides of nickel, copper, and iron, a process has been devised in which a separation of the nickel sulphide is effected by the use of sodium sulphide, advantage being taken of its power of dissolving the sulphide of copper and iron freely and forming a solution of less specific gravity than the nickel sulphide. The matte mixed with coke and sulphate of sodium has been charged into a cupola-furnace. When this charge is smelted the sodium sulphate is reduced by the coke to sodium sulphide and, forming a solution with part of the copper sulphide and iron sulphide, flows with the undissolved and melted sulphides of nickel, copper, etc., through the tap-hole, which is kept constantly open, into moulds, where the molten constituents separate in accordance with their specific gravity, the sodium sulphide containing the dissolved copper and iron sulphides floating on the surface and the undissolved sulphides settling to the bottom. When the contents of the mould have solidified, the parts are separated by fracture and the tops containing the copper and iron are recharged into a smelting furnace, where the sodium sulphide is fluxed off in an iron slag, being then lost. The bottoms contain most of the nickel sulphide of the original matte; but owing to the imperfection of the separation they also contain so much copper sulphide and iron sulphide that it is necessary to resmelt them with fresh additions of coke and sodium sulphate, and thus to repeat the smelting and separation to the fourth or fifth time before the bottoms are brought to sufficient degree of freedom from iron and copper to enable the resultant nickel sulphide to be economically subjected to the succeeding steps of the refining process. The process as thus carried on is slow and wasteful and because of the cost of materials and the amount of labour and handling required adds greatly to the expense of the nickel or nickel oxide which is the final product. I have discovered that these difficulties can be overcome and the separation rendered quick and inexpensive by the following process.

Instead of smelting the compound matte, as heretofore, in a cupola-furnace and running the product continuously into moulds I so smelt the matte that when melted it will remain in a molten state subject to the high temperature of a furnace for a considerable period of time, during which I find that the copper and iron sulphides will be thoroughly dissolved by the sodium sulphide, and in one melting a good separation can be effected, and by two such treatments results are obtained equal or superior to the results of the four or five meltings which have been employed heretofore. For this purpose I employ as the smelting-furnace an

open-hearth reverberatory furnace lined with magnesite brick, as I find that silica-lined furnaces are quickly destroyed by fluxing with the sodium sulphide. Into such furnaces I introduce a charge of nickel-copper-iron matte, either solid or molten, together with coke and sodium sulphate, the latter being preferably present in the proportion of sixty per cent. of the weight of the matte and the coke in the proportion of fifteen per cent. of the matte. The sulphate is preferably added in the form of commercial niter-cake. Where, for example, a fifty-ton charge of matte is treated containing, say forty-five per cent. of nickel sulphide and thirty-five per cent. of copper sulphide, it is melted in the furnace and retained subject to the heat for some time—say four to five hours after fusion has occurred—during which time it is preferably "poled"—that is to say, treated by immersing beneath its surface poles of green wood, which evolve hydrocarbon gases and vapours, and thus aid in the reduction of the sulphate and produce an agitation of the material, which facilitates and renders more thorough the solution of the sulphides to be removed. Nearly complete solution of the copper and iron sulphides in the sodium sulphides reduced from the niter-cake is thus effected, and the molten charge may be tapped from the furnace and allowed to separate in moulds; but to get the best results I tap the different strata from the furnace separately, tapping first the solution of copper and iron sulphides floating on the surface of the bath and finally tapping the undissolved nickel sulphide, or the order of tapping may be reversed, the lower stratum of nickel sulphide being removed first. The great proportion of the iron and copper is thus separated, the nickel sulphide obtained being nearly pure. Where greater purity is desired, the nickel sulphide may be recharged into the furnace and treated again in like manner.

The skilled metallurgist will be able to modify the apparatus and also to use other solvent materials. For example, sodium sulphide may be charged into the furnace instead of sodium sulphate, in which case, as no reduction is required, the coke may be omitted or a less quantity of it employed, and even when sodium sulphate is used deoxidation may be performed by the operation of poling without the use of coke or with only a little coke.

Instead of sodium sulphide I may employ the sulphides of other alkaline metals or sulphide of manganese. —*Nickel Industry, by A. P. Coleman.*

ROCK DRILLS*

By W. L. Saunders.

The drills now in use may be classified as follows:

1. The plugger drill. This is of the hammer type. It is used in its smallest sizes for dressing stone, for trimming, cutting hitches, and for block holes. It is a hand-rotated machine.

2. The Jackhammer. A hammer drill with automatic rotation, used for sinking shafts, for down-hole work in stopes, for quarrying, for drilling in coal, and in rock and ore work wherever down-holes are required. It is held in the hand of the operator and in some mines is used for horizontal work, mounted upon some simple form of support.

3. The stoper. A hammer drill with air feed, usually used without mounting and for up-holes. It has a large field of usefulness, mainly in stopes or rooms and in driving raises.

4. The mounted hammer drill, as exemplified in the Leyner type, used mainly for horizontal, or approximately horizontal, hole drilling, for side stoping, and for driving drifts and tunnels. In this type of drill a combined stream of air and water is discharged through a hollow steel at the bottom of the drill hole.

5. The reciprocating drill, used for heavy down-hole drilling where the stopes are large, and for surface work, drilling deep holes of large diameter.

Plugger drills are largely used for pop shooting, breaking up boulders, trimming walls, and for all light work requiring holes not exceeding 5 ft. in depth. Solid or hollow steel may be used. In the latter case the exhaust air is discharged at the bottom of the hole for the purpose of removing the cuttings. This type of machine is equipped with a simple device for cleaning the holes of rock cuttings which may not have been discharged by the normal process of exhausting in the hole. This device consists of a lever, eccentric in its middle portion and located on the side of the valve chest. A portion of the lever forces a plunger against the valve, stopping the action of both the valve and the hammer piston and thus permitting live air to pass to the bottom of the hole. Where steam is used wooden handles replace the metal ones.

The Jackhammer can be operated either by steam or air, it uses hollow steels, is provided with an automatic rotation and it drills holes to a depth of 15 ft. It is essentially an all-steel drill. The cylinder, for instance, is drop forged, made of special steel, treated and hardened in the bore. Its most interesting feature is its automatic rotation.

The stoper hammer drill is so well known and so generally used that further description is unnecessary. It is but a few years since this machine was invented and its application to general mining work has been very rapid. Thousands of them are in use.

Jackhammer Records.

There is no place where this new type of Jackhammer drill shows to better advantage than in shaft sinking and in bench or foot-wall work in mines and tunnels. For shaft work two or three times the number of drills may be used as formerly. Each man in the shaft who is not engaged in mucking is a driller, the two operations being carried on simultaneously.

At the Newport mine in the Lake Superior iron country a shaft is being driven with Jackhammers. Dimensions of shaft, 11 by 18 ft. in the clear. The progress has averaged 20 ft. per week, using five drills: material, hard quartzite. During February last a progress of 107 ft. was reported, and in March 125 ft., this latter being said to be the record of performance in shaft sinking in that district.

At the Lucky Star mine in the Lake Superior district four Jackhammers are working in a shaft 12 ft. 2 in. by 14 ft. 10 in., drilling ten 6-ft. holes for sinking and twenty 5-ft. holes for squaring after blasting; material, hard diorite. The progress has averaged about 100 ft. per month.

The Norrie-Aurora shaft of the Oliver Mining Co. was sunk 64 ft. in February, employing three 8-hr. shifts of eight men, each using Jackhammer drills, the shaft being sunk, steel timbered and concrete lined. The total hours drilling was 794 man-hours, out of a total of 4,202 man-hours. In this performance the man-hours required for mucking were almost twice that of the drilling, whereas the time charged for blasing approximated that of the drilling; the timbering and lathing combined were slightly under the drilling figure. The remainder of the time was charged to squaring, cutting hitches, piping, etc. During March 105 ft. of shaft were driven and

*Extract from paper presented at Butte Meeting, A.I.M.E., August, 1913.

completed. This included not alone the sinking of the shaft, but the heavy steel sets were placed in position, the concrete slab-lathing was put in place for the entire distance, also the back-runners. The magnitude of the work may be better understood when it is realized that 24,600 cu. ft. of rock were broken and hoisted to the surface, and the labour of placing the shaft equipment, consisting of two skip roads, one cage road, ladderway, pipe compartment, counter balance and back-runners, completing a modern five-compartment shaft, was all performed in 26 days. Each piece of concrete slab-lathing weighed 130 lbs. and the steel sets were made of heavy material. Six Jackhammers were used to sink the shaft.

The East Butte Copper Mining Co. is sinking a shaft through a hard granite formation with two Jackhammers, from the 1,200-ft. level to the 1,800-ft. level, and reports show that from Jan. 20 to Feb. 15 of the present year 110 ft. of shaft were driven, including timbering. During this period they lost 11 shifts due to outside causes, no work whatever being done. Here an average of 28 holes was drilled per shift, 8 cuts 9 ft. deep, 8 lifters 6 ft. deep, 6 back holes 6 ft. deep and 6 end holes 6 ft. deep. Occasionally as high as 33 holes were drilled. The average net drilling time was 5 hrs. This gives a total hole footage per shift of 192 ft., or 96 ft. per drill, an average of 19.5 ft. per drill per hour. The previous best progress, made with heavy tripod drills, was 60 ft. in one month. Size of shaft, 19 ft. 6 in. by 6 ft. 10 in.

J. A. McIlwee, the contractor who drove the Laramie-Poudre tunnel, is sinking a shaft for the Silver King Consolidated mine, Park City, Utah. This is a three-compartment shaft and is being driven a distance of 500 ft. from the 1,300-ft. to the 1,800-ft. level. The work began March 22, with four Jackhammer drills, two on each side of the shaft; four drillers were employed. A great many delays and drawbacks were experienced, mainly on account of water. Some boiler difficulties were incurred, which caused a delay of four days in April. Notwithstanding this, 105 ft. of actual sinking or 95 ft. of completed and timbered shaft have been accomplished. Based on the number of days actually at work sinking, this is a progress of about 5 ft. per day. Holes were drilled 5 ft. deep, the usual time employed being 10.5 min. per hole. The best time made in drilling was 33 holes 5 ft. deep, with 6-ft. cut holes, in 2 hrs. 45 min.; three shifts, each shift gang doing the drilling, mucking, and timbering.

Bench or foot-wall work has heretofore been done with large drills, employing from two to three men per drill. Deep holes of large diameter have been drilled, but during recent years the hammer type, both in the stoper and in the Jackhammer, has replaced the heavier machines for this class of work. In one of the Lake Superior copper mines recent extensive tests have shown the following figures:

Type of Drill	Tons per man per shift	Mining Cost per ton.
Stoper	13	$0.41
Piston	12	0.54
Jackhammer	38	0.12

No overhead charges are included in the above figures of cost, nor are charges for air included. This effective saving by the use of stoper drills over the heavier tripod type, and the still further saving by the use of Jackhammers, cannot be maintained in all classes of work. In this particular case the bench or foot-wall afforded the best opportunity for the use of these little Jackhammer drills.

An analysis of the drill situation, in the iron fields of Lake Superior, indicates that four types of drills are necessary for the economical extraction of the ore, their relative proportion being about as follows:

	Per cent.
1. Mounted hammer drill	20
2. Stope drills	20
3. Jackhammer or sinking drills	10
4. Light piston drill	50

There will always remain a small percentage of drilling for which the two-man piston drill will still be the favorite. An instance is the operation of the Soudan mine at Tower, where the rock encountered is very hard; in fact, it is characterized as the hardest in the United States.

At this time the ore is very hard and dry, and the chief problem is not so much one to be met by the use of some particular type of drill, but rather one of getting the steel to stand, as the bits will not hold in this rock. Records show that as many as 80 starters have been used, with a 3.25-in. machine, to drill a hole 6 in. in depth. Light one-man drills have been tried in this formation, but without success.

In the hematite mines of Lake Superior the light reciprocating mining drill is generally used for the actual breaking of probably 90 per cent. of the ore which requires drilling (hand-auger ground excepted). In this class of work the service required of the drill is light, the ground being classed as very soft drilling, but of such a character as to bring it under the classification of "too hard drilling" for hand augers.

In the city of Pittsburgh, Jackhammers are being employed for driving an 8 by 12 ft. sewer tunnel, 1,200 ft. long. The formation is a hard slate and shale with a decomposed rock top. Single cap timbers are installed and it is necessary to use fore-poling to hold the top. Two drills are installed in the heading, drilling eight 3-ft. holes, with a single steel to the hole. The average drilling speed is 12 in. per minute. Owing to the bad top and the fact that the tunnel passes under two bridge piers and the Pennsylvania Railroad tracks, the shooting is necessarily light; about 2.5 ft. are pulled at each round. Ten feet of completely timbered heading is the advance per day of two shifts.

The following is a record of work done with Jackhammers in the excavation for the Grand Central Station, New York City:

Month.	Hours drilled.	Total linear ft. drilled.	Average ft. drilled per hr.
Sept. 22 to 29	60	950	15 5/6
Oct. 1 to 31	255	4,256	16.65
Nov. 1 to 5	48	800	16 2/3
	363	6,006	16.5

Cost for repairs (2 pawls, 50c. each), $1, or about 1 2/3c. per 100 ft. drilled.

Air pressure, 70 to 90 lbs.

Holes drilled, 4 to 10 ft. in hard New York mica schist.

In the lead mines in southeast Missouri they have heretofore drilled the down-holes in the stopes with the large type of two-man drill. Since the Jackhammer has been introduced in these mines the results obtained have been 60 to 80 ft. of 8-ft. holes per man per shift, while with the old system employing two men they were only able to drill 40 to 50 ft. of 8-ft. holes per shift. In many cases where the vein is exceedingly wide they drill 10-ft. holes as easily and readily as an 8-ft. hole can be drilled.

In the Oliver iron mines in Michigan the record is given as 57 stoper drills operated in the year 1912, with a total expense for repairs for the year of $920.23, or $16.14 per machine per year.

THE PERSISTENCE OF GOLD ORE IN DEPTH*

By Malcolm Maclaren.

A study of the recent literature of ore deposits inevitably forces the conclusion that workers in this branch of geology are endeavouring, in their zeal for the advancement of knowledge, to wrest from the scanty data available more than the simple facts warrant. Data that have been garnered from the examination of a given metalliferous deposit, and that have a real value when applied to the construction of a sound theory of deposition for that metal alone, have been transferred to stay and brace the tottering structure built for another metal, with which the first may eventually prove to have only the slightest genetic affinity, however closely allied they may appear to be to-day. When all the known facts concerning the deposition of any one metal have been collected, collated and analyzed, then, and not until then, may comparisons be made with the data of another metal similarly treated. Some metals—e. g., tin and copper, clearly lie so far apart genetically that no confusion of data has resulted, but the general impression appears to be that the data concerning the ores of other metals are interchangeable. They may often indeed be so, but the time has not yet arrived when transfers may be made with safety. For this reason, therefore, the ores of one metal only, viz., gold, are considered in the following brief review.

As a preliminary, a definition of "depth" appears to be necessary. Here it is assumed to cover only the (presumably) primary ore that lies beneath the zones of secondary enrichment (oxide and sulphide) and to extend for a limited depth, say 1,000 feet, below the bottom of the deepest mines, or 6,000 feet in all. To take the enquiry deeper is to enter the barren zone of speculation. The combined depths of the oxide and sulphide zones of enrichment may vary with climatic conditions from a few feet to a few hundred feet. Ordinarily, below 500 feet we are, for most gold ore bodies, in primary zone. A word may be said in regard to the use of the term "primary ore." It comprises that ore for which we know no prior state of combination and no former locus in space. In this review then, depth is understood to be a zone extending downwards from 500 feet to 6,000 feet below the earth's surface. The ore in this zone may be assumed to have been deposited during a single short geological era, and to owe nothing to accretions of a widely separated and later period. It is probable that the irruption of auriferous solutions was normally paroxysmal in character and indeed was comparable to volcanic eruptions of the present day. Only those fissures and channels that were open at the geological moment, so to speak, were filled with ore. An assumption of this nature may help to explain the vertical variations in the tenor of the ore in the primary zone, where in many mines, horizontal bands of richer and poorer ore alternate. These alternations conceivably represent the varying horizons at which successive upward pulsations of metalliferous solutions either became sufficiently cool to be deposited or met with fluid agents of deposition.

I have elsewhere* attempted to show that the gold deposits of the world fall naturally into well-defined auriferous groups, the members of each group, though widely separated in space, being closely allied in genesis, in character, and in geological age. One of the most important distinguishing characters of the several groups is persistence (or otherwise) of ore in depth. The classification adopted must therefore be outlined.

Classification of the Gold Deposits of the World.

(a) Arising as the end-product (generally following albite-porphyry) of diabasic magmatic differentiation series intrusive into schists.	Pre-Cambrian	Western Australia (Kalgoorlie, etc.), India (Kolar, Hutti, and Dharwar) Rhodesia, Transvaal (Witwatersrand, Pilgrim's Rest, Barberton), Brazil (?), Guianas, Appalachian fields, Eastern Canada (Porcupine, etc.).
	?	(a) Urals.
(b) Arising as the end-product of Granodioritic intrusions.	Permo-Carboniferous to Post-Jurassic	(b) Eastern Australia and Tasmania.
	Middle Tertiary	(c) Western North America (California, Oregon and Alaska).
(c) Associated with andesite volcanic eruptions.		Northern Chili, Peru, Colombia, Mexico, California (Bodie), Nevada, Utah, Colorado, Unalaska, Japan, Sumatra, Celebes, New Zealand, Transylvania.

The above table varies slightly from that originally adopted, but four years' further field experience has enabled me to abolish the former tentative subdivision of the Pre-Cambrian deposits and has given a much clearer view of the general sequence of events leading up to auriferous deposition in that age. These groups, therefore, contain all the important gold deposits of the world. Two of these, viz., the Pre-Cambrian and the Tertiary are extremely well defined; the third, including all apparently dependent granodioritic magmas, is still somewhat indefinite and will certainly be modified with increase of knowledge. Probably, when the exact age of its auriferous impregnation is known, the Ural chain of deposits will be brought into close accordance with the Eastern Australian, while the Californian (Mother Lode, etc.) occurrences may eventually be transferred to the Ter-

*A paper contributed to proceedings of the Twelfth International Geological Congress, Canada, 1913.

*Maclaren, Gold, London, 1908, pp. 42-75.

tiary andesitic group, with which they are indeed orographically closely connected.

In any consideration of the question of the persistence of gold ore in depth the foregoing divisions must be kept closely in mind, since the recurrence of the evidence of the complete dependence of gold deposits on geological conditions, both for deposition and for extension, lateral and vertical, is certainly the most salient feature arising from the study of the goldfields of the world.

The Younger Goldfields.

It will probably be most convenient to first consider the younger goldfields. These are the andesitic fields that have furnished some of the greatest bonanzas that have been known. Their petrological range is from pyroxene-andesite to quartz-trachyte, and occasionally to rhyolite, all apparently the differentiation members of dacitic magma. Their geological range is from Eocene to Pliocene with a special development in the Oligocene and Miocene. With one notable exception they follow very closely and are confined to the so-called "Pacific Circle of Fire," with which line of volcanic activity they have clearly a very close genetic connection. The outstanding feature of gold deposition in this group is its modernity and its consequent intimate association with existing volcanic phenomena. The geographical exception is the Transylvanian goldfield of Hungary, the andesites of which were erupted during the Aquitanian stage, and along lines of crustal weakness initiated in the Oligocene and indicated at the present day by the active volcanoes of the Mediterranean.

Auriferous deposition in this group has probably been closely associated with solfataric action. Maclaurin has indeed shown that the hot springs of the solfataric region of New Zealand at the present day bring to the surface and deposit notable quantities of gold and silver in the siliceous sinter that forms on the edges of the boiling springs. A similar deposit is recorded from near the De Lamar mine, Idaho. The New Zealand hydrothermal region is on the same line of crustal weakness as the goldfields of the Hauraki peninsula. On it, only 40 miles away from Rotorua, is the famous Waihi mine, until three years ago one of the greatest of the world's gold mines. The chalcedonic character of the siliceous filling of the veins of many andesite fields also appears to point to a deposition from hot waters. In andesitic and allied rocks in the neighborhood of auriferous veins "propylitization" is universal. In this facies of the original andesite rock the feldspars and ferro-magnesian silicates have been converted to quartz, sericite, calcite, epidote, chlorite, serpentine and pyrite.

The outstanding feature of auriferous ore bodies in andesitic fields is their general irregularity, both in form and in tenor. The great persistent fault fissures so often found in older and deeper seated rocks are unknown, or, at any rate, have not served as loci of deposition. There is nothing in any andesitic field comparable, e.g., with the Mother Lode fracture of California.

It is, of course, conceivable that strong fault fissures could readily have been formed, but it is improbable that in any active volcanic and solfataric region, such fault fissures would remain open for any length when large quantities of cementing igneous and aqueous matter were being brought to the surface along the assumed line of weakness. The Comstock Lode with a total length of two and a half miles is probably the longest fault-fissure lode of economic importance in the andesitic fields. Normally the fissures of andesitic fields appear to be local tension fractures due sometimes to cooling and sometimes to minor local movements. They are therefore limited both in linear and in vertical extension, falling into the group of "gash veins" of an old nomenclature. When two or more local series of fractures intersect, the "stockwerk" so characteristic of many New Zealand and Transylvanian areas results.

Where the veins of the stockwerk are sufficiently close together a great bonanza may result as in the case of the Shotover and Caledonian mines, Thames, New Zealand. The original irregularity of the andesitic fissures is greatly accentuated by the selective action of auriferous solutions that replace the fissure walls with ore.

No andesitic field has as yet carried its bonanzas to great depths. By far the deepest is the Comstock, where shafts were sunk to 3,300 feet, but though ore was found erratically distributed through the lower workings, it was in nowise comparable to the great bonanzas that occurred between the 1,000 ft. and 1,800 ft. levels. Only a very few mines in andesitic regions have carried rich ore below 1,000 feet, and the characteristic feature of even these is uncertainty of persistence in depth. For the lack of persistence a definite reason may very often be given, viz., the change along the downward course of the lode from dacite or andesite to the underlying basement rock, or, in rarer cases, to a member of the andesitic differentiation series unfavourable to gold deposition. Often the mere approach to the basement rock connotes impoverishment of lodes. Instances are numerous, e.g., in New Zealand (at Coromandel and Thames), in Colorado (at Cripple Creek and Telluride), in Transylvania (at Vulkoj, Korabia, and Nagyag); but there are many lodes that persist in a homogeneous rock, which may be either a member of the andesitic differentiation series or may form a member of the basement complex through which andesites have burst, and that nevertheless show a marked diminution in value at comparatively shallow depths, often less than 500 feet. For some of these impoverishments a physical cause may be advanced, viz., approach to the bottom of the fissure of tension; but for others, indeed for the majority, no such explanation is possible. For example, the Comstock fissure is well defined as far as it has been followed downward. The great Martha lode-fissure (Waihi) persists as strongly as ever below 1,000 feet, but whereas above that level the gangue was mainly quartz, below it the matrix is calcite. The Martha Lode appears to have been originally wholly a calcite lode that was attacked by solfataric waters above 1,000 feet, silica with accompanying gold almost completely replacing the calcite. Either, then, 1,000 feet below the surface marks the horizon at which solfataric waters become active agents of solution and deposition, or, and more probably, the percolating waters had no access to a zone of the lode immediately below the 1,000 foot level. Whether at greater depths they used the lode-fissure as a channel and replaced its calcite gangue future exploration alone can show. Here, as has so often been the case, the solution of the question of the persistence of ore in depth depends on economic considerations.

The impoverishment of the veins of the andesitic goldfields in depth is a feature so universal that a general cause for diminution in value must be sought. I have attempted to show elsewhere that the probable form in which gold travels in solution, in depth at least, is not as the chloride, but as an alkaline auro-

sulphide, and that pyrite and other sulphides are not the natural precipitants in depth, but that precipitation may be due to a more general cause as cooling of uprising solutions.* Recently Lenher,† to whose laboratory researches field workers are deeply indebted, has shown that the alkaline sulphide solutions are highly efficient carriers of gold, that pyrites has no effect on their contained gold and that their gold is readily precipitated by acid waters or by exposure to oxidation. Both these agents may reasonably be assumed to operate only near the surface, especially in volcanic regions. Maclaurin found that the waters of the acid lake on White Island, New Zealand, contained 5.47 per cent. of free hydrochloric acid. Little proof of the existence and wide distribution of acid waters at the earth's surface in solfataric regions is, however, necessary. While the former cause probably operates directly in andesitic regions proper, deposition of gold in the numerous cases in Colorado, Nevada, Translyvania, etc., in which the gold-quartz veins lie in older sedimentary or plutonic rocks, is more likely to be due to oxidizing waters, the influence of which naturally reaches only a short distance beneath the earth's surface.

Recognition of the irregularity and lack of persistence of auriferous ore bodies in andesitic fields is of prime importance to the mining engineer. For such ore bodies not a single ton of ore more than has been actually proved may be assumed.

The Granodiorite Goldfields.

The second group of the classification already outlined includes those goldfields that are apparently genetically connected with granodioritic or closely allied magmas and that occur as a product of their differentiation. This group contains three geographical provinces, viz., Eastern Australia, California, Alaska and the Urals. For the purpose of the present paper they may also be divided simply into (a) lodes in granodiorite and allied rock and (b) lodes in the sedimentary complex through which the granodiorite is intrusive. The relations of the former are simple. Those of the latter are greatly complicated, from the present point of view, by changes in tenor likely to take place when lodes pass in depth from one member of the complex to another.

The deposits of the Eastern Cordillera of Australia are initially dependent on great granodioritic intrusions that have taken place along an axial line of earth folding. Gold-quartz veins may occur either in the igneous rock itself or in the sedimentary strata overlying or adjacent. The habitus of the gold deposits in the north is, in the main, in the granitoid rock; while in the south gold-quartz veins are generally found in sedimentary rocks. Important exceptions to both rules occur and are of special value as evidences of the general genetic connection between the gold deposits of the north and the south, respectively. The general age of the plutonic intrusion is probably late Permo-Carboniferous. All adjacent strata of greater age may therefore carry auriferous veins. Charters Towers in North Queensland, with a production of nearly £29,000,000, is the most important field in the granitoid rocks. Its igneous complex comprises rocks ranging from grey hornblende granite to tonalite, the latter being the predominant rock. The two principal lodes are the Brilliant and the Day Dawn, which have been worked to depths of 2,500 to 2,700 feet. On the whole, the ore has shown a gradual though small diminution of tenor in depth. Similar fields are those of Croydon (Queensland), and Wyalong (New South Wales); neither furnishes any evidence bearing on the point in question.

Considering the number and great importance of the goldfields of Eastern Australia developed in sedimentary rocks the light thrown by them on the general question of persistence of ore bodies in depth is singularly little. Certainly some, as Gympie (Queensland) and Ballarat (Victoria), depend for auriferous deposition on the intersection of lodes or quartz veins and graphitic bands in sedimentary strata, a condition which is not necessarily recurrent at depth. Others, including the majority of the important Victorian fields and the Hargraves field in New South Wales, are developed in tension fractures between unlike beds at the crests of anticlines forming, e.g., the famous "saddle reefs" of Bendigo and Castlemaine. In these fields saddle reefs are successively met with in depth when sinking on an anticlinal axis, so that a condition ensues very different from that met with when considering the filling in depth of a single continuous fissure. But the experience gained on these formations all tends to show that the lower saddles are not nearly so rich or so large as those above. At Bendigo mining operations were carried to 4,614 feet below the surface in the New Chum mine, but it is very probable that, taken as a whole, work on the Bendigo field below 2,500 feet has not been profitable. Certainly the tenor of the ore has decreased in depth.

In the California-Alaska belt of gold lodes, which are apparently dependent on granodiorite magmas, the various Mother Lode mines and the Alaska-Treadwell group in south-eastern Alaska are the most important. The latter are still shallow and are of no help in the present discussion. Many of the Mother Lode mines, especially in Amador county, are nearly 2,000 feet deep, and some, as Kennedy (3,650 feet), Gwin (2,650 feet), and South Eureka (2,850 feet), have reached much greater depths.

The Mother Lode is a fissure zone that may be traced from Bridgeport in Mariposa county to near the northern boundary of Eldorado county, a distance of 120 miles. In many places it is a solid lode 100 feet wide, but often it is merely a shattered zone in which numerous quartz stringers are developed. It is undoubtedly due to major faulting developed along a line parallel with the axis of the Sierras during the uplift of those mountains. The faulting has selected the softest beds (Mariposa slates) of the sediments and has uplifted them for great distances.

So far as my three months' examination of the Mother Lode permitted, I have not been able to make out any appreciable diminution in tenor in depth. Many mines have certainly "bottomed" the ore in given fissures at depths less than 2,000 feet, but it often happens that two or more parallel lodes occur within the Mariposa slates, and that when one becomes barren a hanging wall or footwall lode may carry ore to much greater depths. In few auriferous regions is cross-cutting from wall to wall of the lode channel more necessary; in few has less been done than along the Mother Lode. The mines of Angels Camp are often instanced as evidence of the occasional non-persistence of Mother Lode mines in depth, but, assuming for the moment that no ore occurs there in depth, their evidence cannot be admitted against Mother Lode mines. They are, it is true, on the line of the Mother Lode fissure zone, but from the Hardenburg mines, south of Jackson, to near the Rawhide mine, south of Tuttletown, the Mother Lode fissure zone, keeping a straight course, leaves the Mariposa slates, which curve to the west through the Gwin mine and

*Maclaren, Gold, London, 1908, pp. 38, 78, etc.
†Econ. Geol., Vol. VII., 1912, p. 744.

run parallel for many miles before rejoining the fissure zone south of Stanislaus River. One of the factors (viz., the presence of carbonaceous slates) that makes Mother Lode mine is therefore lacking in Angels Camp.

While, therefore, any given fissure of the Mother Lode series may cease to yield ore in depth, it is probable that ore will be found at greater depth in another adjacent member. Finally, when broadly considered, the Mother Lode may, with unchanged geological conditions, be expected to carry ore with undiminished tenor to and perhaps beyond the limit of "depth" set forth in this paper.

No evidence of value is to be derived from a study of the gold veins of the Urals. They are nearly all small and irregular and no deep mining has been done on them.

Reviewing the scanty evidence furnished by the granodioritic group, we find for Eastern Australia a gradual though small diminution of the tenor of ore bodies in depth, while on the Mother Lode all the evidence points towards a general persistence in depth for typical Mother Lode mines. A mining engineer, dealing with the future of these mines, would not, therefore, unless he had evidence of an approaching change in geological conditions, be justified in disregarding all ore except that "in sight"; some might be expected to occur below the deepest present explorations, and such ore should always be taken into economic consideration.

Pre-Cambrian Goldfields.

The third group of the classification includes all Pre-Cambrian goldfields and comprises the most important now being worked. These lie in two geographical areas, one on the borders of the Indian Ocean, ranging from Western Australia through Southern India and Egypt to Rhodesia and the Transvaal, and the other along the eastern side of America from Eastern Canada through the Appalachian chain and the Guianas to Brazil and Tierra del Fuego. The former is a very well defined group of goldfields that, though geographically widely separated, present so many points of similarity that a geological description of the various rocks and of their internal relations in any given region would serve, with the mere change of place names, for any other region of the group. The members are consequently believed to form a single petrological and metallogenetic province, for which the appellation Erythræan* has been suggested.

A typical Pre-Cambrian field is that of Kalgoorlie in Western Australia. Its total gold production has been more than forty millions sterling. It has been closely studied by the writer and throws considerable light on the general question of auriferous deposition in Pre-Cambrian rocks and on the persistence of ore in depth in those rocks. Briefly, the area is one of ancient schists (mainly calc-schist) through which a quartz-dolerite magma with its differentiation products has intruded. The differentiation sequence appears to have been quartz-dolerite (quartz-diabase) followed first by members as basic as peridotite and then by more acid segregations ranging through porphyrite to final albite-porphyry, the last being often intrusive through the quartz-dolerite. Auriferous impregnation followed closely on the intrusion of the albite-porphyry. Rich lodes have been developed only in shear-zones in a broad dike of quartz-dolerite, the shear-zones being barren when they pass in depth or in linear extension out of the quartz-dolerite. Since the shear-zones are, when considered over depths of 3,000 feet, approximately vertical, and the quartz-dolerite dike, which is parallel to the strike of the shear-zone dips west at 65 degrees, the shear-zones pass in depth out of the dike, the eastern shear-zones with their contained lodes reaching barren ground sooner than the western (see plan and section). Kalgoorlie, therefore, well illustrates an outstanding feature of all goldfields, except indeed some in the Tertiary group, viz., that non-persistence of ore in depth is a function not of depth but of geological structure. In Kalgoorlie three well defined parallel shear-zones may be made out. Taken severally and having regard to the depth factor alone, they show (a) non-persistence of ore in depth (Australia East and Lake View-Perseverance lodes), (b) persistence of ore in depth (Great Boulder and Ivanhoe-Horseshoe lodes), and (c) a probable enrichment in depth (Ivanhoe West lode). Generalizations based on the depth factor alone when geological conditions are unknown are misleading. Rickard,† for example, has relied on the evidence furnished by the failure in depth of the eastern lodes and an impoverishment in the Ivanhoe mine at 2,500 feet to support a general theory of impoverishment in depth. Garrison‡ also quotes the Ivanhoe impoverishment as possible evidence of non-persistence in depth. The Ivanhoe impoverishment does take place, but it is local and is due to the fact that the vertical Ivanhoe lode here passes through a thin albite-porphyry dike dipping west about 65 degrees. The great Boulder lode passed through the same dike with local impoverishment at 2,200 feet. When, however, the latter lode was encountered beneath the albite-porphyry dike it proved as rich as in upper levels, and the same result may reasonably be expected in Ivanhoe deeper levels. So far, then, as the evidence furnished by Kalgoorlie goes, it indicates that, so long as its lodes remain in quartz-dolerite, so long will they furnish ore equal in tenor to that found from the 500 to the 2,000 ft. levels. The Horseshoe-Ivanhoe group of lodes may therefore be expected to carry ore to the 5,500 ft. level, provided always that the quartz-dolerite dike persists, does not flatten in dip, and is not thrown westward in depth by westerly dipping reversed faulting.

Archean strata, from the vicissitudes to which they have been subjected in the course of long geological ages, are normally much folded and disturbed, while lode fissures in them are nearly vertical. It is a fundamental axiom in these older deposits that the nature of the lode wall exercises a vital influence on the richness and sometimes on the mineral character of the ore body. Hence it rarely happens that a great depth is reached before the lode, worked from the outcrop downward, has passed out of the favourable rock. A notable exception is the Champion Reef of the Kolar goldfield, southern India, probably the richest single gold lode ever worked. From 3,200 to 3,800 feet ore as rich as any obtained in the upper levels is now being worked and ore may be expected to persist in this fissure as long as it remains in the favourable hornblende-schist.

The greatest goldfield of the world, viz., the Witwatersrand, responsible for 37 per cent. of the world's gold production, is a Pre-Cambrian goldfield, but the criteria of ordinary Pre-Cambrian fields do not apply to it. Its deposits lie in sedimentary quartzites and conglomerates and are undoubtedly decreasing in tenor in depth. Having regard to all the geological conditions surrounding auriferous deposition on this field, it may be assumed that its gold was deposited relatively near the then existing surface and that deposition was due either to cooling on approach to the

*Maclaren, Trans. Inst. Min. Met., Vol. XVI., 1907, p. 15.
†Min. Sci. Press, Aug. 31, 1912, p. 264.
‡Loc. cit., Nov. 30, 1912, p. 701.

surface or to admixture with oxidizing waters, which in basin-shaped sedimentary areas as those of the Witwatersrand, we know from analogy with artesian areas, may reach to depths of several thousand feet. The surface of most Pre-Cambrian goldfields, on the other hand, has been subjected to erosion during a large portion of geological time, and the locus of gold deposition though now comparatively near the surface, was at the period of impregnation many thousands of feet below the then existing surface and beyond the reach of oxidizing waters, perhaps even beyond the influence of thermal changes.

Summary.

Where auriferous ore bodies have been deposited by the influence of meteoric oxidizing waters or by cooling on approach to the earth's surface, they may reasonably be expected to diminish in tenor with increasing depth and finally to disappear. The deposits to which this generalization appears to apply are those of the Tertiary andesitic group. Even for many of these, non-persistence of ore is more often a function of geological structure than of increase in depth. For all other deposits, and especially for those of the Pre-Cambrian group, ore formed in strong well defined fissures may be expected to persist unchanged (apart from local horizontal variations) in "depth" provided the rock of the lode walls is homogeneous and that the ore-bearing fissure does not pass out of that rock. In all these, therefore, geological structure and not "depth" is the factor controlling the persistence of ore. "Depth" exercises only an indirect control, inasmuch as the greater the depth the more is the likelihood of geological change.

THE USE OF COMPRESSED AIR IN CYANIDATION*

By Herbert A. Megraw.

Compressed air has long been used in various branches of metallurgy for the ordinary mechanical purposes common to every industry, but in the cyanide process of recovering gold and silver from their ores there are several applications peculiar to that system which do not apply to industry in general and which may be of interest. Especially is this true regarding that modern development of the process known as "all sliming," in which ore containing precious metal is ground to such a point that nearly all of it will pass a fine wire screen having 200 openings per linear inch, and is then stirred or agitated with the cyanide solution.

The Cyanide Process.—Primarily the cyanide process is simple. Gold and silver are soluble in aqueous solutions of the alkaline cyanides, so that simple soaking of the metal-bearing material is sufficient to accomplish the dissolving of a portion of the desired metal, which is subsequently recovered by precipitation from the solution. Combinations of gold and silver exist, however, which are not so readily soluble in cyanides, so that stronger chemical forces must be brought to bear upon them, and in other cases the metal is so finely divided and distributed through the rock, being practically sealed into it, that the dissolving solution cannot reach it unless the rock is first reduced to an extreme state of sub-division. Thus complications are introduced, many of which have no proper place of mention in this paper; but others, whose successful overcoming has been accomplished by the use of compressed air, will be mentioned.

Any of the alkaline cyanides may be used for dissolving the precious metals, but in practice either potassium or sodium cyanides are used as they are more stable and more easily manufactured and handled. Potassium cyanide was the first salt used, and there are even now operators who believe it is best adapted to particular ores; but the general opinion is that either of the two mentioned may be used with equal effect. Because sodium cyanide contains more cyanogen in the same weight, it is being more largely used, a consequent saving in transportation expense being obtained. Occasionally other cyanide combinations are more efficacious (in the case of particularly rebellious ores) and bromo-cyanides are made use of, but in general the simple sodium cyanide is all that is required for most satisfactory results.

The process is based upon what is generally known as Elsner's equation, which is the chemical reaction expressing the combination of gold, potassium cyanide, and oxygen producing the soluble potassium-gold salt.

$$2\ Au + 4\ KCN + H_2O + O = 2\ KAu\ (CN)_2 + KOH$$

This reaction exhibits the actively necessary part played by oxygen in the process, and indicates the reason for its introduction by artificial means into its practical application. The reactions illustrating the dissolution of silver are somewhat more complicated, although the result is the same kind of a cyanide compound, but the necessity for oxygen is even more pronounced. Many methods of chemically supplying the element have been proposed and tried, but they have been almost universally set aside as being expensive, complicated, and offering no advantage over ordinary air. The opportunity to combine mechanical and chemical service in one agent has been too apparent to remain overlooked, so that at the present time compressed air is one of the most universally-used aids to the process.

First Use of Compressed Air in Cyanidation.—In the early days of cyanide metallurgy, the approved method of treating an ore was to grind it rather coarsely, place it in a tank containing a filter bottom, and leach it with the cyanide solution. By this method the surface of the charge in the tank—that portion exposed to the action of the atmosphere—gave a good extraction of its contained metal, while the interior of it—that portion with which the air could not come into contact—was found to give up its metal content at a much slower rate and in less degree. Believing that oxygen was what was needed, some operators introduced compressed air under the filter bottom and forced it up through the charge, aerating the material thoroughly. This was one of the first uses, if not the actual pioneer application, of compressed air in practical cyanidation. The idea was even covered by patent, the scheme being to fill the bottom of the tank, under the filter, with a network of stationary pipes perforated with small holes into which air could be forced to find its way through the sand in the tank. This operation was sometimes varied by connecting the bottom of the tank with the intake of a compressor, drawing air down through the charge. This latter procedure was found to induce packing of the charge and was not considered as satisfactory as forcing the air upward, which loosened the sand and made it more permeable.

*From Engineering Magazine, Jan. 19, 1914.

Sand and Slime.—Finding that fine material interfered with rapid and even leaching of the tank contents, the two were separated and the clean sand leached by itself, a much more satisfactory method. The finer material, at first discarded, was later found to contain a good proportion of the valuable metal, often the most of it, and the problem of its treatment arose. It could not be leached, as it was too fine and packed so tightly in the tank as to be practically impermeable, and the only way in which it could be satisfactorily extracted was to keep it in suspension in cyanide solution while the dissolving progressed, and to separate the two after the extraction of the valuable metal was complete. The fine material, by common consent, has been called slime; and while the exact definition of the word has been the subject of much controversy, it is generally taken to mean the extremely fine clayey or colloid portion of the ore which may not be successfully leached. Its treatment bothered operators for many years, and in the devising of an applicable method, the agitation system, now highly perfected, was born.

El Oro Methods.—At the mill of the El Oro Mining & Railway Co., at El Oro, Mexico, one of the early plants in America to attempt the separate treatment of slime, the material was agitated in shallow, rectangular tanks by means of compressed air introduced through a hose moved from point to point by an operator. The system made use of the mechanical efficiency of the air in keeping the solids in suspension, and also the oxygen in the air to supply that necessary in the completion of the chemical reaction. This method was troublesome and expensive, requiring too much labor to be economical, and was soon replaced by round tanks in which the agitation was mechanically done, using a central vertical shaft provided at the bottom with arms for keeping the solids in suspension, and air was added either through fixed pipes in the tank or into the suction of a centrifugal pump used to assist agitation. A later development made use of a hollow vertical shaft through which air was introduced, passing thence through hollow agitating arms and escaping through a series of small holes, thus combining mechanical and air agitation at the same time. These methods gave good results; but the notion of "killing two birds with one stone" had not been forgotten, and agitation by means of compressed air alone was studied until the tank known as the "Brown" or "Pachuca" was developed and became almost universally used.

The "Pachuca" or "Brown" tank is a tall cylinder of steel plate having a cone-shaped bottom and is fitted with a tube vertically placed in the centre. This tube acts as an air lift, raising the mixture of solid and solution and discharging it near the top of the tank, thus maintaining a constant circulation and giving no opportunity for the solids to settle. The tank is very tall in comparison to its diameter, made so in order to minimize the chance of settling; and to further this object, the cone bottom is made so steep that solids can hardly remain on it. The usual dimensions of the standard tank of this kind are about 15 feet in diameter and 45 feet deep, although in some cases the proportions are varied. The central tube reaches from near the bottom of the tank, where compressed air is admitted, to within a few inches of the top. This latter point is the subject of many variations, some operators maintaining that the necessary conditions are complied with when the tube reaches only half way up the tank. It will be seen that this is an air lift working under practically ideal conditions as to submergence, and power requirements are not large. In a standard tank, which will hold about 100 tons of dry slime at the usual dilution, the operation is stated to require about 100 cubic feet of free air per minute, compressed to 25 to 50 pounds per square inch. The higher pressures are required to start operations after the tank has been without agitation for some time, and the lower ones to maintain agitation after it has been started.

The Trent System.—Having thus devised a method of treatment which accomplished a straight air-agitation treatment, operators continued to experiment with means of improving it and reducing its cost. The height of the "Pachuca" tank, as it is usually called in the United States, militated against its economy, as it is generally believed now that it requires more power than should be necessary for the performance of its duties. Many other systems have been invented and put into use, most of which use compressed air as motive. One known as the Trent system operates by the use of a centrifugal pump in a tank of large area, having a flat bottom, and comparatively low. Such tanks may be 20 to 30 feet in diameter and 10 to 15 feet deep. The pump is fed from a point near the surface of the tank and forces the pulp through an appropriate gland in the tank bottom into a system of arms, made of pipe, placed so that they may revolve near the bottom of the tank. The arms are fitted into a grit-proof bearing, and the pulp exits are all curved in one direction, the force of the discharging pulp causing them to revolve in the tank after the fashion of an automatic lawn sprinkler. To supply oxygen to this system, air is introduced into the pump column from a compressor; or this may be done by arranging a sniffle valve in the suction, although this is likely to reduce the efficiency of the pump.

The Dorr Agitator.—Probably the latest claimant for honor as an agitator is that known as the Dorr, which uses a flat-bottomed tank like that in the Trent system. The mechanism is like that used with the well-known Dorr thickener—a central shaft carrying two arms, inclined upward at an angle from the centre. Upon the bottom of these arms are a series of inclined blades, which act as rakes, drawing the settled material toward the centre of the tank. Upon reaching the centre, the slime comes under the influence of an air lift, which circulates it much as it is done in the Pachuca tank. The discharge of this air lift may be free, as in the Pachuca tank, or through a distributing canal fastened to the central shaft; in the latter case the discharged slime is distributed over the entire surface of the tank. Here again the air is made to serve two purposes. The particular advantage claimed for this tank is that it requires very little power, the mechanically moved arms revolving very slowly and requiring only from ¼ to ½ a horse power, while the air lift has no great height and small quantities of air under low pressures may be used. Tanks with flat bottoms and great area, compared with their height, are preferred on account of their low installation cost and also the influence upon the first cost of the milling plant. When tall tanks are used, costly excavations are required in addition to the heavy installation expense of the tanks themselves.

It is, of course, not to be thought that the devices mentioned cover the entire field of slime agitation, as many other ideas have been put into practice; but they do represent the most successful types and indicate the essential fact that air can be made to perform two distinct functions at the same time.

Other Uses of Compressed Air in Cyanide Plants.—In addition to the uses named, compressed air performs

many other duties about the cyanide plant, most of which, however, are purely mechanical. The air lift is used for elevating both pulp and solution, and compressed air is often used in connection with filtration, the separating of the solids from their treatment solutions. The precipitate resulting when gold and silver are thrown out of the solution is pumped through a filter press, either by means of direct-action pumps or by a monteju, and the cake formed is often partially dried by passing compressed air, sometimes heated, through it. Compressed air is largely used in the operation of fuel-oil burners to melt the precipitate into bullion, and in many other ways this transformation of energy may be considered almost indispensable about the modern cyanide plant. While all of these uses are important, naturally the one in which both chemical and mechanical properties are utilized is most prominent.

THE TREATMENT OF ZINC ORES*

By A. J. Colelough Nettell.

It will be my endeavor to point out that the deposits of British Columbia are capable of treatment locally, and by methods that are in every-day use in Wales. To this end I will roughly sketch the history of the zinc industry from its inception in England, and the various processes employed, both for the smelting of docile and refractory ores.

The real history of zinc starts in Silesia. It was from the deposits there that the first metal came. The furnaces of to-day have many of the characteristics of the original Silesia furnace. It is my intention, however, to deal with the English history of the metal.

Zinc was first known to English miners in the mines of North Wales, where it exists in mechanical mixture with galena. The charter for the oldest of these mines, "the Halkyn," was granted by Charles I. At this time zinc was unknown to commerce, and for many years after it was of no value to the miners. As time passed along the Silesians began to mine and produce zinc, and it then became necessary for a process to be discovered to separate and concentrate the metals from the above ores.

A Concentrating Method Devised.—After years of trial and experiment, Messrs. Green, of Aberystwyth, to some extent perfected a process sufficiently good to enable the zinc blende to be commercially treated. This process consisted of a water concentration over jigs and buddles and treatment in huge tubs called "Gogwrs" in Welsh, and "dollies" in English, and this process with improved type jigs, percussive tables of the "Wynne type" replacing the "buddles," is the one in general use to-day, and is giving every satisfaction.

The Morriston Spelter Works.—Once it became possible to separate satisfactorily the blende and the galena, it became necessary for a smelting process to be evolved to deal with these products. The lead was already provided for, and the Silesians had been for some time treating blende, and that very big and powerful corporation, known to the world as the "Vieille Montagne," was operating at Liege, in Belgium. The late Lord Swansea, afterwards head of the firm of Vivian & Sons, then turned his attention to this industry, and about halfway through the last century inaugurated the smelter, known from that time to to-day as the Morriston Spelter Works. He engaged a French metallurgical engineer, named Alfred Borgnet, to take up the control of this department, and work was commenced. The process then used was in general principle that used both in England and elsewhere, and although the furnaces have undergone a very radical and complete change, the general principles are much the same now.

The Welsh Furnaces.—The early furnaces, or, as they are now called, the Welsh furnaces, consisted of huge fire grates built below ground level in pits, known as "caves," and from ground level up of huge brick boxes into which were placed tiers of clay pots to the number in some cases of sixty pots arranged in five tiers. This portion of the furnace was known as the "Block," and in this the flames from the underground fire places circulated around the pots, raising the heat to the necessary point for the distillation of the metal.

Above the "Block" was built a calciner, or roaster, operated by the surplus heat from the block below, the whole of the gases from the spelter furnace and calciner being carried into the smoke stack provided for each furnace.

The charge for the largest of these furnaces was 3,000 pounds and the yield of metal was considered good at 50 per cent. of the metal contents and more frequently was below rather than above this figure.

Gas Producers Used.—This class of furnace continued in operation in all the spelter works in Swansea until Siemens perfected his gas producer, when the spelter-men grasped the possibilities of a furnace in which the heat was obtained from this source. Then came a period of radical change, the calciners were built separately, each smelterman using the one that suited his fancy, the number of tiers of pots was reduced to three and the length of the furnaces increased to give room for the same, and even a greater number of pots, and, consequently, greater charges, and so was gradually evolved the present-day furnace of 154 pots and four-ton charges.

But even whilst the furnaces were being so improved the yield of metal did not increase with the same rapidity, and all the metallurgists were keenly at work trying various fluxes to aid in increasing the yield of the, by this time, very valuable metal. So by slow stages was evolved the present-day process as worked in Swansea, whereby a yield of 90 per cent. is obtained and under good conditions even higher than this.

Welsh Ores Contain Fluorine.—The ores treated now are principally obtained from Spain and Algiers. Although there are still great quantities in the North Welsh mines, they unfortunately now carry fluorides. Until some means is found of eliminating this element, the Welsh can only be worked in very small quantities. Fluorine is fatal to the pots.

Broken Hill Ores.—A period of experimenting was started when the Broken Hill deposits of docile ore

were exhausted, and the sulphides or complex ores came before the public. It became necessary to find some method of extracting all the values from these ores, and process after process was evolved for this purpose. Although most were failures, each one taught us some lesson on the treatment of zinc and put us probably one step further toward the goal of treatment whereby all the values of ores of this and other complex class could be recovered.

James Process.—It would take too long to epitomize all the processes brought out, so I will confine myself to those that I have been personally more or less intimately connected with. The first of these being by a metallurgist named Christopher James, who worked on the chemical fact that on the meeting of sulphides and oxides under heat, reduction takes place. A number of experimental charges were worked and some results obtained, but the mechanical difficulties did not warrant any further experiment on these lines.

An Improved Process.—Then came another process, where this principle was acted on, together with the principle employed in Parkes desilverizing process, and some better results were obtained. This process consisted in passing the finely ground blende, or complex ore carrying silver or gold values in addition to the zinc and lead, into a bath of highly heated litharge. Reduction took place and as fast as this occurred the face of the bath, at least, was further oxidized by means of an air blast. When the bath was considered sufficiently enriched or in danger of overflowing the fire was damped and the bath cooled back. While cooling it was agitated with paddles until below the melting point of zinc. The zinc contained rose to the surface of the lead in a crust carrying most of the silver, gold and copper with it, and was skimmed off. The zinc was then distilled off leaving the copper and other values in the distil pot or in the zinc pot residues for subsequent treatment. This process gave good results, and I cannot say why it was not prosecuted further.

The Burnham Process.—Next came the "Burnham" process, so called after the metallurgist who brought it out. It was taken up by a London syndicate, and a lot of money was spent on it. It consisted of an agglomeration of the crude ore with nitre cake whereby, it was claimed, the zinc was converted into zinc sulphate. The soda absorbed the siliceous gangue of the ore forming sodium silicate which passed through the subsequent blast furnace treatment practically without change. The resulting scoria from this treatment was then either treated in a spelter furnace or by leaching. It, however, did not work out as claimed and so was not continued.

An Electrical Process.—Next was an electrical process patented by a metallurgist named Grant. This consisted of the deposition of the zinc from its solutions by electrolysis. It was found so difficult to maintain the necessary absolute evenness of current to this end that this process also was relegated to oblivion.

Sulman-Picard Processes.—Later have come the two processes of Messrs. Sulman & Picard. The first of these was worked at the Emo Works, just outside Swansea. It consisted of the briquetting of the ore with coking coal, pitch being used as the bond, and the subsequent distillation in the spelter furnace. The zinc was distilled off and caught in the usual way. The silver, lead, copper or other metals were left behind in the coke formed. This was the most feasible process up to that time, but unfortunately they reckoned without the silica, and instead of metallic lead carrying the silver or gold values being formed, a basic-silicate of lead was the result. This is exceedingly difficult of treatment and results in heavy losses of the higher values. So the process was abandoned. In the opinion of the writer, it might have been made a good and paying process, by research into the field of fluxes.

The Bi-sulphite Process.—These gentlemen next brought forward the process known as the bi-sulphite process, now the property of, and exploited by the British Metal Extraction Co. The company has spent an enormous sum of money on experiments to perfect the mechanics of the process. The process consists of the elimination of the zinc from the other constituents of the ore by means of its own sulphurous acid. The bi-sulphite of zinc thus obtained is converted into zinc oxide by heat. The operators have obtained the zinc oxide; but are still faced by the difficulty of smelting to metallic zinc by ordinary methods. As the oxide of this metal is light and bulky it is very difficult, if not impossible, to get anything like a full charge on to the spelter furnace. This will entail increased cost in the treatment and I much doubt if the materials will stand it. However, I wish them every success.

Conclusion on Treatment Methods.—From the foregoing list of failures, and partial failures, it will, perhaps, have occurred to your minds that zinc looks impossible, but this is far from being the true state of the case. Zinc is just as amenable to treatment as any of the other metals, given the necessary environment, and the proof of this is that the metal is being worked at a profit on a very large scale to-day.

It is not my intention to go into figures, as these may be obtained from the Governmental Blue Books of the various countries that work this metal. What I have been trying to impress by the foregoing, is the fact that zinc in some of its phases is not so amenable to chemical treatment as its metallurgy would lead one to believe. But my opinion, based with all respect, on twenty-odd years experience of this metal in both its docile and refractory forms, is that the present method in common use is the best up-to-date, and that consists of an initial concentration of the ore, calcination and subsequent treatment by means of the furnace employed in Swansea which combines all the best points of the Welsh, Silesian and Belgium furnaces, and is, I am firmly of opinion, the best for the purposes.

Application to British Columbia Ores.—The deposits of British Columbia, at least those I have seen, appear to be quite amenable to concentration even when in admixture, as some of them are, with copper. Such being the case, the subsequent treatment should present no difficulty by the ordinary direct smelting method. If copper and other values are present they can be recovered by the subsequent treatment of the residues.

Importance of Mechanical Arrangement of Ore Particles.—There are methods other than chemical, which will do this concentration and separation, but I would like at this juncture to point to one fact which I think many engineers overlook, and that is that although the ores come from the same district and even from the same lode, they vary enormously as to their mechanical arrangement. This is one of the most difficult points to be faced by the concentrator, and although the general principles of any concentration process may be the same, yet the details must be worked out to suit each individual ore.

Reason for Neglect of B.C. Zinc Ores.—We have in British Columbia huge deposits of zinciferous ores

which, at present, in all but very isolated cases, are being almost entirely neglected, and why? Because, as far as my information enables me to reply, of the heavy freights necessary to take these ores to the nearest smelters, customs duties, penalties, etc., which eat up all the value of the metal contained in the ore. In one case I saw the smelter returns, and after all these deductions had been made there actually remained for the payment of mining and concentrating charges $7.50 per ton. This was on an ore making 45 per cent. zinc, and zinc was at this time worth about 7c. per pound. Yet there is no move being made to alter this. Around Vancouver there are zinc deposits which could be worked at a considerable profit if there was a smelter within reach. There are others that you gentlemen know better than I do. Yet these products to be got to market must be sent across the line into the United States.

The Market for Zinc.—It is open to proof that there are profits in zinc smelting and mining, and yet no endeavor to cut into the market for galvanized sheets, zinc salts or other form of zinc product has, as yet, been made. What is galvanized iron worth to-day in Vancouver? I am credibly informed $100.00 to $110.00 per ton. The English manufacturer obtains for his about £8, or $40.00, per ton.

Vancouver is nearer and quite as well supplied with bottoms as England, to supply the South American, and Oriental markets. She is better situated than England in that she has within the province the crude material, the coal and even natural gas. England has to import all the ore now treated there.

India presents a big field for the marketing of zinc chloride which is used for the burnettizing of their railway ties; China and Japan for galvanized sheeting and other zinc products.

I have not in the foregoing processes made any very serious mention of electrical ones, as my experience has caused me to be somewhat prejudiced. I am informed that experiments are now being carried out along these lines in the province, so I refrain from passing any opinion.

I am also informed that experiments of this kind were carried out some time since in this province by a metallurgist named Schneider, but I understand they were not wholly satisfactory.

Finally, I would suggest that if a process should be wanted in a young, if one may use the term, province like British Columbia, the Swansea process I have given would be the most suitable, as it has stood the test of time. Other improvements and adaptations, that might from time to time be found necessary to meet requirements, could then be built up around this process.

B. & A. ASBESTOS COMPANY.

B. & A. reports a good profit from operations during 1913.

The mine now operated by the B. & A. Asbestos Company was first discovered in the fall of 1908 by a Mr. Labonte, a French-Canadian prospector, who sold it to the present owners in December of the same year. Construction of the plant was commenced early in 1909. At that time, the mines at Thetford Mines and Black Lake were supplying most of the asbestos produced in the Province of Quebec, and, with the mines at East Broughton, Belmina and Rumpelville, which had then just been opened, competition was so great that the opening of another new mine seemed a foolhardy venture. Undaunted, however, by this and by the discouraging advice of their friends, the directors of the company pushed forward with the mine. Needless to say, they encountered many difficulties. Labor was scarce, on account of lack of accommodation for the men, the initial daily production was small, and, owing to the mine being practically unknown, what little fibre they did produce, they were unable to sell. Early in 1910, the company was re-organized, more capital was added, and operations were resumed on a larger scale. Improved machinery was installed to provide for a larger output and accommodation provided for the laborers. The daily production, under these improved conditions, increased gradually, month by month, during 1910, 1911 and 1912. In 1913, the B. & A. Asbestos Company had an average output of 125 tons of asbestos fibre daily, more than produced in a single day by any two other mines in the world. Nor has quality been sacrificed for quantity. The fibre is clean, long and free from grit. Experience and constant supervision has reduced the cost of production to a minimum. The percentage of fibre obtained from the rock on this property is far above the average.

The company is enlarging the pit and installing additional equipment with a view to increasing the efficiency.

The company is not contemplating an amalgamation with any East Broughton mining companies, as might be inferred from a paragraph in our last issue.

MAGNETIC IRON ORE SURVEYS.

The Department of Mines has published reports by E. Lindeman on Austin Brook Iron-Bearing District and Magnetite Occurrences along the Central Ontario Railway. The reports are accompanied by a number of maps prepared by Mr. Lindeman and his assistant, Mr. W. M. Morrison.

HAILWOOD LAMPS PASS BELGIAN TEST.

The Belgian Government has signed the authorization approving of the use in Belgium of the Hailwood oil lamp and also the Hailwood naptha lamp, as manufactured by Ackroyd & Best, Ltd., Morley, England.

The Belgian Government tests are far more severe than the British Government tests, natural gas from the Grand Trait mine being employed in the gas tests. The lamp is subjected to most explosive mixtures of this gas and air at velocities of 5, 7, 9, 11, 13 and 15 metres per second, which is equal to from 984 feet per minute to 2,950 feet per minute. The whole series of the tests being repeated in horizontal currents, downwardly descending currents at an angle of 45 deg., upwardly ascending currents at an angle of 45 deg., vertical ascending currents and vertical descending currents.

These authorizations are especially interesting as the Belgian Government will not now add new lamps to their list unless they show special merit, and the details of the lamp are scrutinized very severely.

PERCENTAGE RECOVERY IN ORE DRESSING

By Edgar P. Anderson, Cobalt.

In the recovery of metals from the rocks in which they occur, it is generally necessary to concentrate them in the form of metallic minerals before the metal is extracted by smelting operations. In thus concentrating the mineral a loss always occurs, so that the actual mineral recovered for smelting is a portion only of the original content. The ratio of the metal in the recovered portion to the metal contained in the original ore when multiplied by one hundred is called the Percentage Recovery.

In practice this factor cannot as a rule be determined directly, as the concentrate may be wet or oily and is usually inconvenient to weigh. The metal in the ore delivered for concentration may be more easily determined, since its dry or actual weight can be found, by sampling for moisture and deducting the weight of water. Generally weights of the various products can be accurately determined at a testing works, where comparatively small parcels of ore are treated as a guide to practical work. For testing works the only percentage recovery which should be taken as correct is the following:

Percentage recovery

$$= \frac{100 \times \text{wt. of concentrate} \times \text{assay value of concentrate}}{\text{weight of ore} \times \text{assay value of ore.}}$$

It is the recovery obtained that is wanted, not the loss sustained. The latter may serve as a check, since the tailing loss plus the metal recovered should not be greater (nor much less) than the metal in the original sample.

To obtain the percentage lost in the tailing the following calculation must be carried out.

Percentage loss in tailing

$$= 100 \times \frac{\text{metal in tailing (=assay} \times \text{weight)}}{\text{metal in ore (=assay} \times \text{weight)}}$$

and metal in ore should be equal to metal in concentrate+metal in tailing.

In practice there are two methods available (both dependent on sampling) supposing that the total weights of products cannot conveniently be obtained.

1. The ore is sampled and its average metal content obtained as a percentage. The concentrate is also carefully sampled and the assay value determined. The samples taken should be large and are taken as a certain fraction of the whole over a considerable period, say one shift. These samples are dried, so that water is driven off and also oil, if used, but nothing else. If any solid, added during treatment, is found in the concentrate, such as carbon, magnetite, iron, etc., the weight of added material must be deducted from the concentrate. The percentage recovery can then be estimated as for a test sample.

This method is very good but gives unnecessary work for comparative day to day runs.

2. The ore feed is carefully sampled periodically and the assay value in metal returned as a percentage. The concentrate obtained is also sampled over the same period and the percentage assay value determined.

The following formula gives the percentage recovery quite close enough for practical work, the errors being due to sampling and assaying only.

$$E = 100 \frac{c\,(a-b)}{a\,(c-b)}, \text{ where}$$

E=extraction rate per cent.
a =assay of ore per cent.
b =assay of tailing per cent.
c=assay of concentrate per cent.

This formula is made up from the assay values and the concentration rate.

The formula may be proved thus:

$\frac{c}{a}$ =concentration rate or the ratio

$$\frac{\text{assay value of concentrate}}{\text{assay value of ore sample.}}$$

(a—b)=assay of ore—loss in treatment=proportion of metal taken out of the ore.

(c—b)=assay of concentrate—loss in treatment=proportion of metal concentrated.

Formula says:

$$\text{Extraction} = \frac{\text{proportion of metal in concentrate} \times \text{proportion of metal taken out}}{\text{proportion of metal in ore} \times \text{proportion of metal concentrated.}}$$

That is, if there were no loss in the tailing metal extracted=metal in ore, and metal in concentrate=metal concentrated, dividing out in the above equation the total metal extracted=1, which is correct.

To obtain the percentage loss in the tailing the following formula may be used, the symbols having the same significance as above:

$$\text{Loss in concentration per cent.} = 100 \times \frac{b - \frac{b}{R}}{a} = 100 \times \frac{b - \frac{ab}{c}}{a}$$

where $R = \text{concentration rate} = \frac{c}{a}$

This result may be added to the extraction and should give 100, serving as a check on the extraction determined from the concentrate value. For convenience the loss may be determined very quickly because of the smallness of the figures involved and subtracted from 100 to give the approximate extraction, say when in a works and wishing to know "if the treatment is going satisfactorily this morning."

That is

That the addition of the extraction and the loss give the metal contained, is shown by the following:

Using the same symbols, and R=concentration rate.

then $R\,c + (1-R)\,b = a$ (1)

$$\text{for } R = \frac{a-b}{c-b}$$

$$\text{and } 1-R = \frac{c-a}{c-b}$$

Substitute values for R in formula (1)

$$\frac{a-b}{c-b}\times\frac{c}{a}\times\frac{c-a}{c-b}\times\frac{b}{a}=1$$

That is metal extracted+metal not extracted=1

=metal in ore.

In ore dressing operations there are often intermediate products, or 'middlings,' to be treated again. Such products will complicate the formulae given above. Mr. C. W. Wright in the Mining Magazine of July, 1911, gives the following derived formula.

$$E=100\times\frac{Wc\times Ac}{(Wa\times Aa)+(Wb\times Ab)+(Wd\times Wd)}$$

where E=extraction per cent.

Wa=weight of ore feed, of assay value=Aa.

Wb=weight of tailing, of assay value=Ab.

Wc=weight of concentrate, of assay value=Ac.

Wd=weight of middling, of assay value=Ad.

Percentage recovery may be checked graphically, and the graphs or curves, obtained by several successive recovery tests, will enable percentage recovery to be determined directly. Graphical treatment has been dealt with by Mr. Sharwood in the Mining Magazine for December, 1910.

True extractions are usually difficult to obtain, and, when submitted, are frequently misleading, owing either to omission of products or by the intention of interested parties.

ORE SHIPMENTS FROM COBALT SILVER DISTRICT IN 1913.

According to the Cobalt Nugget, the shipments from Cobalt mines during 1913 amounted to 20,916.26 tons, a decrease of 500 tons from the shipments for 1912. Taking into consideration the amount of concentration and bullion reduction of the Cobalt mines this reduction is noteworthy, and, as compared with a 500-ton reduction in the 1912 figures from the 1911 figures, it shows a steady shipment from Cobalt during the last year.

The list shows two new shippers during the year, the Lumsden and the Gould, although a number of old faces have passed away and new ones substituted. In place of Silver Queen, Aladdin appears. Caribou-Cobalt appears for the Drummond shipments for the year Orion supplants Silver Cliff, and York Ontario the old King Edward. In addition Lost and Found or General mines made a shipment from a North Cobalt group of properties early in the year. The silver Bar shipped its first carload, although on two previous occasions the name has appeared with test shipments.

The general average of the various mines was about on a par with last year, with one or two specific decreases and a corresponding number of increases. Sencca-Superior, which stepped into the shipping class late in 1912, appears last year with a heavy total. Buffalo, always a heavy shipper in the past, now reduces the silver into bars and ships by express, showing a decrease in the tonnage from the camp. Of the larger mines, Nipissing shipped slightly in excess of the previous year residue from the high-grade mill, rich in cobalt and nickel oxides, but low in silver values, predominating. La Rose shows a decrease of some 200 tons, while McKinley shows an increase of a couple of hundred tons. Coniagas' decrease was 500 tons, but to offset this, Cobalt Townsite increased shipments by 800 tons.

Other mines show slight fluctuations, both decreasing and increasing tonnage, and this, together with the fact that the bullion shipped was much greater and increased concentration, argues well for 1913 as a banner year in Cobalt.

Last year 27 mines appeared on the shipping list; this year there are 31 mines, an increase of four. Mines which appeared this year and not on last year's figures included Green Mcehan, Lumsden, Gould, Silver Bar, Orion (Silver Cliff), and York Ontario (King Edward), while the Hargraves and Provincial do not appear on the list.

The following figures compare the shipments by months of 1912 and 1913:

	1913.	1912.
January	1,657.83	1,235.07
February	1,718.06	2,063.63
March	1,980.09	1,678.13
April	1,601.76	1,782.79
May	1,839.50	1,928.72
June	1,649.07	1,707.37
July	1,494.77	1,669.55
August	1,586.30	1,980.12
September	1,603.56	1,871.48
October	1,423.11	1,775.61
November	2,268.48	1,608.48
December	2,093.73	2,380.84
	20,916.26	21,631.79

By years the tonnage from the Cobalt camp is as follows:

	Tons.
1904	158.55
1905	2,336.01
1906	5,836.59
1907	14,851.34
1908	25,362.10
1909	29,942.99
1911 e.	33,976.97
1911	24,921.71
1912	21,631.79
1913	20,916.26
	179,934.31

PEAT.

The peat deposits of Canada are quite extensive and constitute an important reserve of fuel that has as yet been but little utilized. The most important areas so far as known are those found in the Provinces of Quebec and Ontario. A number of these have been systematically examined and surveyed by the Mines Branch with a view to determining their character and extent. The Branch has also carried out a comprehensive investigation of the fuel values of peat, having built a plant in Ottawa for demonstrating the feasibility of the manufacture and use of peat gas in gas engines. During the past two years air dried peat fuel from the Government bog at Alfred was sold in Ottawa, and peat from a privately owned bog at Farnham, Quebec, was disposed of in Montreal. In both cases the fuel was in considerable demand for use in open grates and in kitchen ranges. The Alfred bog is now being operated as a private enterprise and a considerable production is anticipated.

CYANIDING SILVER ORES AT NIPISSING MINE, COBALT*

By James Johnston.

The cyanide plant is placed in a building apart, but connected to the battery and tube mill building. It is arranged in two floors, the upper one containing all the slime collecting and the cyanide treatment vats and the lower floor containing all the solution vats, slime filters, and pumps.

There are on the upper floor:

Three 34 ft. diameter by 13 ft. deep slime collecting vats,

Seven 34 ft. diameter by 13 ft. deep slime cyanide treatment vats,

Two 34 ft. diameter by 13 ft. deep stock slime pulp vats for charging filters,

One 34 ft. diameter by 13 ft. deep barren solution vat.

These vats are placed in two parallel rows, and, with the exception of the solution vat, they are all fitted with a mechanical stirring apparatus, driven by a line shaft placed over the vats on a wooden bridge or trestle. The paddles in the vats are made of 4 by 6 in. pine on edge and the two longest arms are 27 ft. in diameter and revolve at 8 rev. per minute, giving a speed on the end of 678 ft. per minute; paddles are located at 2 ft. from the bottom of the vat.

These 12 vats are driven by a 125 h.p. motor, and as on an average 8 of them are agitating at one time, the power necessary to drive vats and shafting is 55 kw. Each vat has an average working load of about 140 tons of dry slime plus about 280 tons of solution.

The slime collecting vats are arranged with a circular overflow around the top on the inside, 6 in. wide by 8 in. deep, over which the clear battery solution flows into the launder leading to the lower battery solution vat. The bottoms of the vats are connected to a 7 in. diameter and to a 4 in. diameter centrifugal pump for transferring the thickened pulp, and a 6 in. diameter decanter is fitted to the side of the vat.

The battery pulp is run into one of these vats for about 9 hr., collecting about 92 tons (dry weight) slimes, and during this collecting period the excess solution overflows to the lower battery solution vat, from which it is repumped for circulation in the battery solution circuit. When the necessary charge is collected, the pulp is switched to collect in the next vat and in the meantime the slime is settling, excess solution being decanted until the pulp in the vat represents about 1.5 solution to 1 slime. The pulp is now agitated for about 1 hr., the depth of pulp measured, sampled, and specific gravity determination made for slime tonnage. The specific gravity of dry slimes on this ore is 2.7. The calculation made here, as previously noted, works out at practically the same tonnage as the weighed-in weight of the ore, after due allowance has been made for the addition of lime and tube mill pebbles.

The thickened pulp of 1.5 caustic soda solution at 0.25 per cent. strength and 1 of slime is now pumped to the desulphurizing treatment.

Desulphurizing Process.

The problem of working out a successful all-cyanide treatment for the Cobalt ores, in which there is such a varying amount of complex minerals, led to the discovery, during the period of experimental work, of what is now known as a wet desulphurizing process. The details of the reactions involved and the necessity for such a treatment will be obtained by referring to J. J. Denny's article. (See page 711, Nov. 15, issue.) Briefly explained, the preliminary desulphurizing treatment breaks up the refractory silver minerals when the slime pulp is brought into contact with aluminum in a caustic soda solution, the silver being left in a spongy metallic state readily amenable to cyanide treatment.

The desulphurizing is accomplished by passing the slime pulp through a revolving tube mill, in which there is a quantity of aluminum, and a further treatment is given in a vat lined with aluminum plates, in which the pulp is slowly agitated.

The practical effects of this preliminary treatment on the ores has resulted in the same and sometimes a better extraction being obtained in 48 hr. cyanide treatment than was otherwise obtained in 120 hr. cyanide treatment with no desulphurizing. In some of the ores which contained a greater proportion of the refractory minerals a better extraction of from 1 to 4 oz. per ton is obtained when desulphurized and cyanided, as compared with a cyanide treatment and no desulphurizing.

A tube mill, 4 ft. in diameter by 25 ft. long, lined with 2 in. thick Silex blocks, is used for the first stage of the desulphurizing treatment. This mill revolves at 10 rev. per minute and carries a load of about 4,000 lb. of aluminum ingots, cut up into cubes about 1.5 to 2 in. The slime pulp is fed through this mill at the rate of 14 tons of dry slimes per hour, diluted with 1.5 caustic soda solution to 1 dry slime. The pulp then gravitates into the 34 ft. diameter by 13 ft. deep alkali stock pulp vat, which is arranged with mechanical agitation and lined around the side with aluminum plates. The pulp is agitated in this vat about 24 to 36 hr. or until it is gradually drawn off in about 40-ton charges to the dewatering filter box. On account of keeping the mill cyanide solution in balance, it is necessary to eliminate as much as possible the crushing caustic soda solution from the slimes before they are transferred into the cyanide vats for treatment, and this is done in a Butters filter plant equipped with 60 leaves, which is capable of dewatering 270 tons of slimes per day, the cake when discharged carrying 26 per cent. alkali solution as moisture.

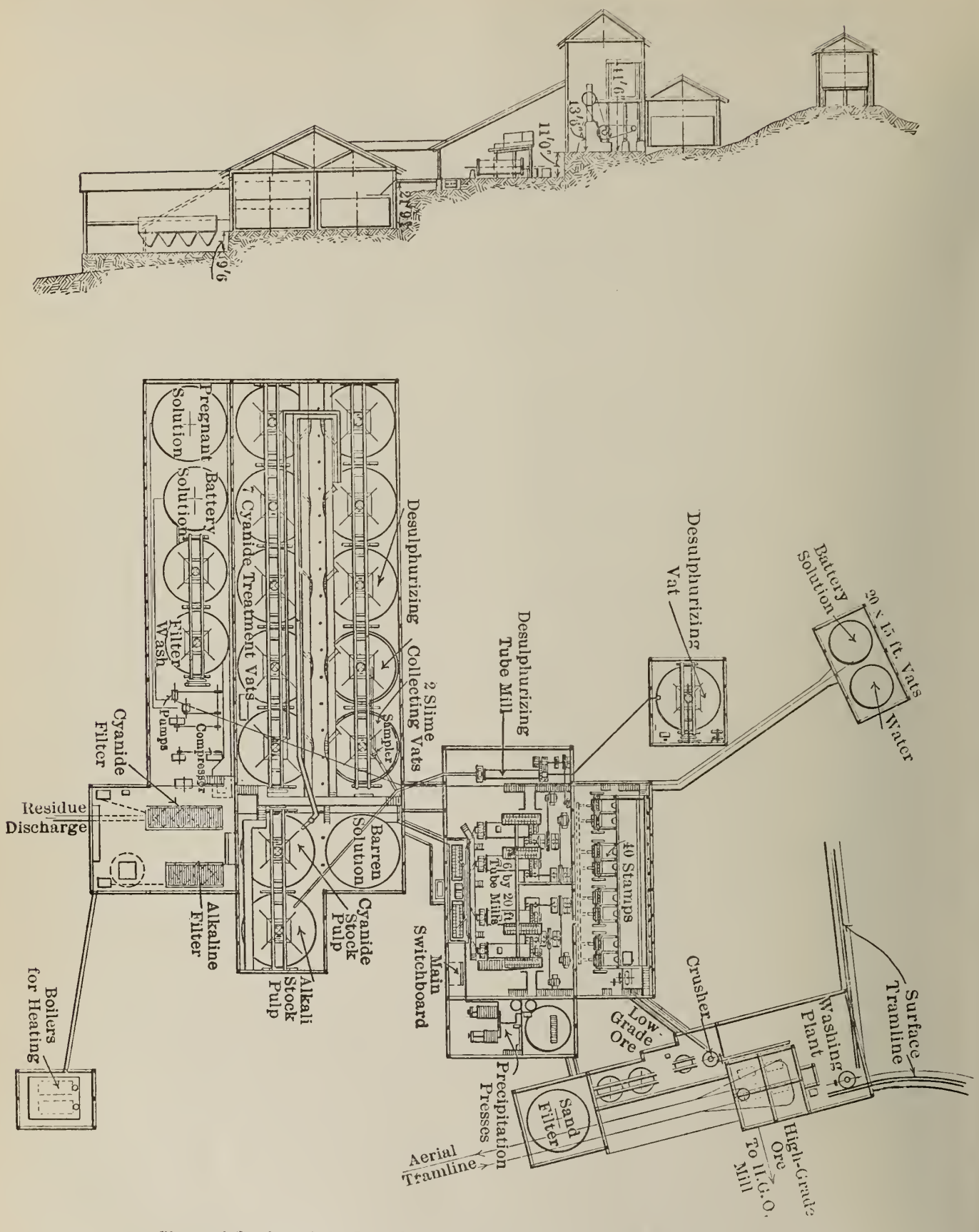
The slimes after dewatering flow into a 16 ft. by 5 ft. deep pulping vat, where they first come in contact with cyanide solution, being diluted with about 2 of cyanide solution to 1 of slime. A 4 in. diameter centrifugal pump is used for transferring the pulp into the cyanide treatment vats.

Cyanide Department.

There are seven, 34 ft. diameter by 13 ft. deep slime treatment vats, fitted with mechanical stirring arrangement. Each vat has a 6 in. diameter decanter, for draining off the clear settled cyanide solution; they are also fitted with a 6 in. diameter air lift operated by a 0.75 in. diameter pipe with air at 20 lb. pressure.

The slimes are treated in charges of about 130 tons dry slimes in a vat, with a dilution of 2 of solution to 1 of dry slimes in a 0.25 per cent. cyanide solution and 0.20 per cent. alkali, agitation being maintained for 48 to 60 hr. Repeated testing in the mill has demonstrated that equally as good an extraction of the silver values

*Extract from a paper on the Mill and Metallurgical Practice of the Nipissing Mining Co., published in Bulletin of the A.I.M.E., January, 1914.



Plan and Section of the Low-Grade Ore Mill of the Nipissing Mining Co., Limited.

is obtained with a 2 to 1 dilution as with a 3 to 1 dilution. The air lift is operated all the time the charge is being treated, so that there is a possible turning over of the charge about 16 times by the air lift.

After the agitation treatment, the charge is allowed to settle, so that the clear solution may be decanted to the pregnant solution vat. The pulp is then agitated and transferred by a 7 in. diameter centrifugal pump to the 34 ft. diameter by 12 ft. deep cyanide stock pulp vat, in which it is kept agitated until drawn off into the filter box.

A Butters filter plant equipped with 80 leaves handles

35 to 40-ton charges in about 3 hr. each, the slimes being discharged with 26 per cent. of moisture. The alkali and the cyanide filters are arranged alongside of each other, so that the same operator handles both boxes from the switchboard placed between them. The filter plants are arranged on the semi-gravity plan; a 10 in. diameter centrifugal pump with 12 in. diameter suction and delivery pipes and hydraulically operated valves is connected with the cyanide box for transferring the excess pulp and solution wash. The clear solution from the cyanide filter box is delivered to the pregnant solution vat and the residue slime is dropped into the empty box, discharging by gravity to the residue dump.

The alkali filter box is connected to an 8 by 10 in. duplex double-acting piston vacuum pump with a displacement of 340 ft. per minute at 160 rev. per minute.

	Heads. per Ton.	Total Silver.		Extraction.	Average Residue per Ton.	Total Residues.
79 tons of	2,648.47 oz.	=209,229.13 oz.	at	99%	26.484 oz.	= 2,092.29 oz.
7,320 tons of	26.00 oz	=190,320 oz.	at	92%	2,080 oz.	=15,225.60 oz.
7,399 tons	54.00 oz.			95.66%	2.34 oz.	

The cyanide box has a 12 in. diameter by 10 in. stroke duplex double-acting piston vacuum pump with a displacement of 770 ft. per minute at 160 rev. per minute.

The pregnant solution vat is 34 ft. diameter by 8 ft. deep and the barren solution vat is 34 ft. diameter by 13 ft. deep.

Precipitation Department.

The original plans of this section of the mill were laid out with the intention of using zinc dust for precipitation and an equipment was installed of one 20-frame and one 10-frame 52-in. Merrill precipitation presses with 3-in. frames, together with the other necessary machinery.

Before the mill was ready to start, the experimental work on the use of zinc dust as a precipitant had disclosed that the cyanide solutions after precipitation rapidly deteriorated and fouled, so as to lose their dissolving efficiency. The investigation on this subject has been very fully explained in E. M. Hamilton's and J. J. Denny's articles and proves how impossible it would be to use zinc dust and get good results. After considering various other methods of precipitation, it was decided to use aluminum dust as the precipitant and modify the equipment accordingly.

The practical benefits gained by this change are:

No fouling of cyanide solutions, with a corresponding reduction in dissolving efficiency.

The working mill cyanide solutions are in a more active condition to dissolve silver than if they were freshly made up solutions which had not yet been used, showing in their favor an increased dissolving power of 0.35 oz. of silver per ton of ore.

A regeneration of 0.608 lb. of cyanide per ton of solution precipitated, equal to about 1.67 lb. of cyanide per ton of ore treated, or 408 lb. per day.

The recovery of silver precipitates averaging about 27,000 oz. per ton, or about 93 per cent. silver.

The pregnant solution is pumped to the precipitation room by a 6 by 9 in. vertical triplex pump, running at 54 strokes per minute, where it is clarified in a sand filter before flowing to the special tank arrangement for mixing the aluminum dust in the cyanide solution. It is then pumped into the precipitation presses by another 6 by 9 in. vertical triplex pump. The 20-frame press takes about four days to fill up with precipitates when handling about 550 to 600 tons of solution per day with a head assay running about 8.25 oz. and a tail assay 0.10 oz. The aluminum dust consumption over a nine months' period averages about 0.556 lb. per ton of ore treated, or 1 lb. (avoir.) dust=45.26 oz. (troy) silver precipitated, or 1 lb. (avoir.) dust= 3.104 lb. (avoir.) silver precipitated. The precipitates are sent to the refinery, where they are melted and refined in a reverberatory furnace, as described in R. B. Watson's article, and eventually shipped as bullion at 997 to 999 fine.

Extraction.

The following figures represent the average extraction obtained from a run-of-mine ore of 54 oz. of silver per ton, in the combined metallurgy of the high-grade and low-grade ore mills:

To this will be added the further recovery of 85 per cent. of the silver, made on the sale of the above 26.484 oz. of residue.

The working mill costs are here represented in the percentage that the various most important expenses bear to the total cost.

Labor	28.207
Cyanide	19.943
Electric power	14.542
New construction supplies	5.586
Aluminum dust	4.761
Aluminum ingots	4.709
Caustic soda	1.811
Aluminum plates	1.401
Refinery fluxes, fuel oil, coke, etc.	1.332
Pebbles	1.284
Battery supplies	1.013
Lime	0.579
Sundry supplies	14.832
	100.000

The annual meeting of the Western Coal Operators' Association was held at Fernie, Crowsnest district, British Columbia, on January 9. Those present were Messrs. Lewis Stockett and W. F. McNeill (Secretary), Calgary; John Brown, Hillcrest; A. C. McGibbon and O. E. S. Whiteside, Coleman; Jas. Howard, Taber; J. C. Reid, Lethbridge. These are all Alberta members of the Association. Owing to illness, Mr. W. R. Wilson, manager of the Crowsnest Pass Coal Co., was unable to attend.

A press despatch from Washington, D.C., January 15, says: Preliminary tests of Alaskan coal from the Bering River district have been very discouraging to officials who hoped they might develop a new fuel supply for the navy. Rear Admiral Griffin, in charge of the investigation, has reported to the House Naval Affairs Committee, that the Bering river coal tested so far has fallen so far under expectations in practical use as to be of no value, but from the Matanuska fields and other sections of the Bering district from which coal is yet to be tested, the navy is hoping for better results.

BOOK REVIEWS

HEATON'S ANNUAL—Heaton's Agency, Toronto. Price $1.00. Postage 12c.

The 1914 edition of Heaton's Annual has come to hand. With this issue, the Annual arrives at the end of its first decade. The first edition was compiled in 1904 for the Department of Commerce of the Dominion Government, to meet the requirements of British firms doing business with Canada, and 15,000 copies were purchased and distributed by the Government in Great Britain and continental Europe. Year by year the Handbook has been gradually developed with special regard to its original purpose, and to meet the requirements of those who want a book of easy reference to answer questions regarding the Dominion. In the first 214 pages will be found information on the Customs Tariff and Regulations, the digest of the Customs Laws and Regulations, includes all the memoranda and bulletins that are issued by the Department of the Customs Officials. This information cannot, so far as we know, be found collected in any other single volume. The Shippers' Guide, giving population, banking accommodation, and railway connections in every banking town in the Dominion is a new feature.

The second half of the book contains a concise, up to date description of all the towns in Canada of any commercial importance, including the leading hotels in order of merit, the existing industries, and special opportunities for new industries. To this is added a section covering such subjects as agriculture, fur-farming, commerce, education, finance, fisheries, forests, immigration, mining, population, professions, railways, game laws, water powers, etc.

FIRST AID IN MINING (Metalliferous Mines)—by Louis G. Irvine—Published by the South African Red Cross Society, Johannesburg, S.A., 1913.

This little book of 115 pages has been issued as a supplementary to the First Aid Manuals in general use. It contains specific information regarding accidents in mines. Suggestions are given regarding the equipment of Emergency Stations and of the First Aid Box. A resume of the treatment of wounds, hemorrhage and fractures is given. Methods of transport of injured persons are described. The discussion of accidents resulting from the fumes of explosives and other forms of "gassing" is especially noteworthy.

The several chapters are devoted to, materials provided for First Aid Treatment in Mining Accidents, First Aid Treatment of Ordinary Emergencies and Accidents Underground, Transport of the Injured in Mining Accidents. Accidents from Poisonous Gases, Accidents due to Electricity, Cyanide Poisoning.

Copies of the book may be obtained from the McGraw Hill Co., 239 West 39th Street, New York, U.S.A.

FIRST AID (Miners' Edition)—American Red Cross Abridged Text-book on First Aid—By Major Charles Lynch and Lieut. M. J. Shields—P. Blakiston's Son & Co., Philadelphia—Price 30 cents net.

The needs of miners, so far as might be, in respect to first aid instruction, were met in an earlier book of this series which was called the "Industrial Edition." This, however, was for other industries as well as for mines. Now, the spread of the first aid movement in a vast number of mines has seemed to demand a special book for miners. Furthermore, experience has shown that instruction in safety and in first aid should go together even more than was thought at first, though in all the Red Cross first aid manuals the importance of the subject of prevention as a part of first aid instruction has always been insisted upon. The reception of the former editions of the Red Cross first aid books was very gratifying. It is hoped that a larger experience will make the present edition more useful and practical.

The chapters are headed, What First Aid to the Injured Is; Directions for Giving First Aid; Shock, Bandages, Injuries, Bleeding, Suffocation and Artificial Respiration, Drowning, Electric Shock, Gas Poisoning, Unconsciousness or Insensibility, Poisoning, How to Carry Injured, Safety, Care of Injured, and Organization of First Aid Instruction. While the book seems to have been specially written for coal miners much of the information contained is quite applicable to metal mines as well.

The volume is a neat paper bound one of 181 pages and numerous illustrations.

PERSONAL AND GENERAL

Mr. W. E. Segsworth is in England.

Mr. Donald G. Forbes, of Victoria, B.C., is spending the winter in Great Britain.

Mr. C. L. Dennison and other directors of the Buffalo mine, spent a week at Cobalt and Porcupine during January.

Mr. Chas. F. Caldwell, managing director of the Utica Mines, Ltd., has returned to Kaslo, B.C., from a visit to Ontario.

Mr. W. R. Wilson, general manager for the Crowsnest Pass Coal Co., Ltd., has been sick at his home in Fernie, B.C.

Mr. John D. Galloway, has been gazetted assistant to the Provincial Mineralogist for British Columbia. His headquarters will be at Victoria.

Mr. Jay P. Graves, vice-president of the Granby Consolidated Mining, Smelting & Power Co., is at Pasadena, California, for the winter months.

Mr. Oscar Lachmund, general manager for the British Columbia Copper Co., was at Butte, Montana, last month, returning to Greenwood about the middle of January.

Mr. A. Hickling, director of the Princeton Coal and Land Co., has left Princeton, Similkameen district of British Columbia, on his homeward journey to England.

Mr. C. A. Foster is reported to have completed the purchase of the shares of Messrs. Tough & Oakes in the Tough-Oakes mine at Kirkland lake for the Kirkland Lake Proprietary, Ltd. Mr. Foster has returned to London.

Mr. Charles Emmerson, formerly superintendent for the West Canadian Collieries, Ltd., at its Bellevue colliery, western Alberta, recently returned to Bellevue from Peru on a visit.

Mr. H. A. Guess, brother of Professor Guess, of Toronto University, has been made consulting engineer for the American Smelting and Refining Co. His headquarters will be in New York City.

Messrs. C. E. Smith, of Toronto, P. A. Robbins, of Porcupine, and O. E. S. Whiteside, of Coleman, have been nominated by the Council of the Canadian Mining Institute to fill vacancies on the Council.

Mr. John Brown, general manager of the Hillcrest Collieries, near Frank, Alberta, was taken seriously ill about the end of December. He was taken to Calgary to have an operation performed to give him relief.

Mr. Oscar V. White, superintendent for the Slocan Star Mines, Ltd., in charge of the well-known Slocan Star group of mines near Sandon, Slocan, British Columbia, has been spending a few days with relatives in Spokane, Washington.

Mr. J. Thomas, mine superintendent at Passburg, Alberta, is spending a vacation at the mineral water spring near Frank, for the benefit of his health. In his absence Mr. N. Howells is in charge of the coal mine at Passburg.

Mr. M. S. Davys, of New Denver, B.C., managing director of the Silverton Mines, Ltd., operating the Hewitt-Lorna Doone group of silver mines and a concentrating mill near Slocan lake, has been on a visit to Spokane, Washington.

Mr. Frederic Keffer, of Greenwood, engineer and geologist for the British Columbia Copper Co., has been on a visit to family connections in Cleveland, Ohio, whence he went to New York before returning to British Columbia.

Mr. Wm. Fleet Robertson, Provincial Mineralogist for British Columbia, has been appointed Provincial Assayer as well, the latter office having been vacant ever since the resignation of Mr. Herbert Carmichael, who retired at the end of 1912 after having been fully twenty years in the service of the Provincial Government. Mr. D. E. Whittaker remains Assistant Assayer, and as well he is now Public Analyst for British Columbia.

Press despatches during the week indicate that Raoul Madero, a younger brother of the late President Francisco Madero, of Mexico, is now the chief adviser of General Villa, commander of one of the warring factions in Mexico. Raoul recently assisted General Villa at the capture of Chihuahua. Raoul Madero is a graduate from the Michigan College of Mines, as is his brother Julio.

Mr. John Hopp, who has for years been operating several hydraulic placer-gold mines in the vicinity of Barkerville, Cariboo district, B.C., has staked part of the ground near Quesnel Forks, also in Cariboo district, worked for years by the Consolidated Cariboo Hydraulic Mining Co. with the late Mr. John B. Hobson as general manager. Six or seven years ago Guggenheim interests acquired the property, but after spending between $200,000 and $300,000 on extension of the water supply system, there came a period of financial stress, and this enterprise was practically abandoned and eventually the right to the ground lapsed.

Arrangements are being made for holding a meeting of the Western Branch of the Canadian Mining Institute in Vancouver, B.C., on Thursday, February 19.

Canadian Allis-Chalmers, Ltd., has issued a bulletin on jaw crushers.

The Herbert Morris Crane & Hoist Company has issued a bulletin describing Morris Overhead Runways recently installed.

The Short Session for mining men at the College of Mines, University of Washington, Seattle, Washington, opened on January 5 with a registration of 44 mining men from 10 States, Alaska, and 5 foreign countries. The course lasts three months and is arranged in sections for quartz, placer and coal miners.

The Roberts and Schaefer Company, engineers and contractors, Chicago, have just secured a contract from the Paint Creek Collieries Co., Charleston, W.Va., for the building of a new coal mining plant in which the Marcus Patent Picking Table Screen will be installed. This new tipple will be built at Olcott, W.Va. Approximate contract price $27,000.

The Harlan Coal Mining Company, of Louisville, Ky., has also awarded a contract to the Roberts and Schaefer Company for a new Marcus coal tipple and retarding conveyor from mine, which plant will be built at Coxton, Ky. Contract price $25,000.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Only occasionally is there available much information concerning mining in Cassiar district. Quite recently there was issued by the British Columbia Department of Mines, Victoria, a "Preliminary Review and Estimate of the Mineral Production, 1913." The following summary of the year's progress in the several divisions of Cassiar district has been taken from that bulletin:

CASSIAR DISTRICT.

The extensive area known as the Cassiar District includes the following mining divisions: Atlin, Stikine, Skeena, Queen Charlotte, and Portland Canal.

Atlin Mining Division.

Atlin has become the most important placer-gold district in the province, and is estimated to have produced this past season about $320,000 worth of gold, which represents about 60 per cent. of the provincial output of that metal. This is an increase of 10 per cent. over last year's production, and is the greatest output the camp has made since 1908.

It is encouraging to note this increase in a placer camp, for, while it was assisted by a favorable season as to weather and water supply, it was chiefly obtained by increments on old properties and the development of new producers.

Pine Creek.—The Ruffner properties on Pine creek still continue to be the most important in the camp. The Guggenheim properties on Tar flats, held under lease by the Ruffner companies, are reported to have done better than usual, the output, in default as yet of official figures, being estimated at about $75,000. The North Columbia Gold Mining Co. is likewise estimated to have produced about $45,000, probably a little less than last year. There are few individual miners on Pine creek, and they are not expected to have made any important output.

Boulder Creek.—The Black claims are the most important on this creek, which, together with the individual miners, are expected to have produced about $10,000 worth of gold. Gold Run did not make any material production this year.

On Birch creek, H. P. Pearse was the most important producer, being estimated to have obtained about $16,000, while individuals obtained from $2,000 to $3,000.

On Otter creek, J. E. Moran is estimated to have recovered some $4,000.

The miners on Wright creek are said to have obtained from $4,000 to $5,000.

On Ruby creek, T. M. Daulton's company, the Placer Gold Mines, is reported to have done exceptionally well, having, after some years' preliminary development, struck very rich ground. Of this fact there seems little doubt, but as to the amount of gold recovered there is a wide margin between the various unofficial estimates obtained; but it seems safe in this preliminary

estimate to credit the company with $35,000. The company is said to have had delivered in Atlin some $12,000 worth of high-carbon steel plates for lining its sluiceways, so it would appear as though the company not only had money in hand, but also high expectations from its property. The development of this property is one of the new features of the camp this past season.

Spruce Creek.—It is reported that the Spruce Creek Power Company did not operate. On the Gladstone lease, James McCloskey, though said not to have taken out quite as much as in 1912, is still credited with some $45,000. Individuals working on Spruce Creek—of whom there are quite a number—are reported to have realized in the neighborhood of $44,000; included in this are material outputs by McPherson, Matthews, and others.

Only a small output is expected from Wilson creek, probably not over from $1,000 to $2,000.

On McKee creek, the individual holdings have been pretty well absorbed by the one large company operating on the creek, the Pittsburg-British Gold Company, which is reported to have had a successful season and to have recovered about $35,000, from which it is unofficially reported dividends were paid to the extent of $10,000.

O'Donnell river seems to have proved attractive to J. M. Ruffner, who has been developing property there, since he had not "come out" by the end of the year, and, consequently, definite information is as yet lacking. He is said to have been meeting with fair success, although his output this year is not expected to be much over $3,000.

The area of the Atlin placer-gold field seems to be gradually extending and promises well for a continuance of its production.

Mineral Claims.—The only lode mine producing in this division is the property of the Northern Partnership—formerly the Engineer group—on the east side of Taku arm. The property is and has been equipped for some years with a 2-stamp mill, which has been in operation for a considerable part of this past season, producing a certain amount of gold—how much is not known, although it is claimed that the quartz treated was quite rich.

Mr. O. H. Partridge and Hon. M. Edgerton were developing the Ben M'Chree at the southern end of Taku arm, but appear to have at least temporarily abandoned that work, and have been engaged in development work on the White Moose, on the west side of the arm—not on the old location on the beach, but some distance up the hill to the westward—with what they claim to be very satisfactory results.

The claims in Rainy Hollow, on the headwaters of the Klehini river, do not appear to have had much attention this past season, further than the assessment work necessary to keep them alive.

Good roads have been built into the district, but no serious work has resulted on the claims, nor any output recorded.

Stikine and Liard Mining Divisions.

In the Stikine division proper there is no mining going on, and as far as is known very little prospecting; all that has been heard of is a little on the Iskut river by the Iskut Mining Company. There is no placer-mining in this division.

The southeastern portion of the division includes a large part of the Groundhog coalfield, which was described in last year's report, and in which during this past season work has been confined to prospecting, with no serious development, and nothing further has been learned that would indicate the future of the camp.

In the Liard division the only work going on is a certain amount of placer-mining in the vicinity of Dease lake. The only important workings there are those of the Boulder Creek Mining Company, operating a hydraulic plant on Thibert creek, fully described in last year's report. This company has been at work all season, working in the new pit, which is reported as proving very satisfactory and producing a fair amount of gold, the exact amount not yet being known.

The flats at the mouth of Dease creek, described in the report mentioned, have this year been the scene of extensive drilling operations by two companies, for the purpose of testing the gold-tenure of the gravels, which, if these preliminary operations prove satisfactory, will lead to the establishment of a dredging plant, to which mode of working the ground is eminently suited.

Queen Charlotte Division.

As yet, no report of actual production this year has been received from the Queen Charlotte division. On Graham Island, prospecting for coal has been carried on by several parties in the interior of the island, but the results so far obtained have not as yet proved coal of commercial importance.

Boring for oil has been going on at the north of the island, without having met with success.

The British Pacific Coal Mines, which partly equipped a colliery on Skidegate inlet last year, has apparently not continued work to any great extent, nor become a producer.

The very interesting discovery was made that a part of the seam opened up at this place consisted of a peculiar form of carbon, which has been classed by a Russian geologist as schungite, and is described as an intermediate state between anthracite and graphite.

The practical peculiarity of the mineral is that, while it has all the appearance of being good coal, it will not burn and cannot be ignited in a blast-gas flame.

On Moresby Island, on the east coast, the usual amount of development and assessment work has been done on the claims near Lockeport and at Ikeda bay, while work has also been done on Huston inlet claims and on Copper Island, Kunghit Island and Collison bay.

On the west coast of the island, on Tasu harbor, important work has been carried on all year by Mr. R. R. Hedley and associates in developing a copper property containing magnetite impregnated with copper-pyrites. A crosscut adit tunnel has been driven in for 300 feet, which, according to Mr. Hedley's sampling and assays, cuts several bands or zones of mineralization. One band 40 feet thick assayed 2.5 per cent. copper; another, 13 feet thick, 2.85 per cent. copper; and the balance about 1.5 per cent. copper, with a little gold and silver. On account of the excess of iron in the ore, it proved so attractive to the smelter that Mr. Hedley has been offered smelting rates practically free of charge. Mr. Hedley hoped to be able to ship several hundred tons before the close of the year, but it is not known whether he succeeded in doing so.

Skeena Mining Division.

The most important development in this division and on the coast has been the progress made at Granby bay, on Alice arm of Observatory inlet, by the Granby Consolidated Company in equipping its Hidden Creek mines with a mining and smelting plant capable of treating 2,000 tons of ore a day.

A review of this sort will not permit of a detailed description of the plant; it is sufficient to say that it will be up to Granby standard, and will include a most up-to-date mine equipment, while the smelting plant will include blast-furnaces, converters, etc. A great part of the plant has already been erected, and it is almost certain that the summer of 1914 should see it in operation.

The mine has been already described in the reports of this department, but it might be said that the company estimates it has blocked out above the working-adit 8,000,000 tons of 2.2 per cent. copper-ore, which estimate is practically endorsed by the mining engineer sent by this Bureau to examine the property. An average of about 1,000 men has been employed during the summer of 1913.

On Alice arm, in addition to the Granby Company's holdings, this Bureau has official reports showing that some twenty miles up the Kitsaulte river, which flows into Alice arm, there are deposits of copper-ore of a workable grade which the present development would give good reason to believe are of very considerable extent, rendering it probable that this section may also develop into an important copper camp.

Near the Granby Company's property—but not included in it—seemingly extensive bodies of copper-ore have been found on the Bonanza and Groundhog claims. It certainly would appear as though the mineral wealth of this section was just beginning to be discovered.

At Kwanitza, forty-five miles up the Grand Trunk Pacific Railway from Prince Rupert, salt has been discovered, and a small quantity extracted in an experimental way. A large basin occurs at this point on the creek, and on the edges of the basin brine was found to be seeping out. Some four boreholes have been put down in the basin, and each yielded a heavy brine, carrying about ¾ lb. salt to gallon of brine. One of the holes had at the bottom crystalline salt mixed with clay. While much yet remains to be proved, it seems probable that the basin contains a large deposit of salt. The quality of the salt evaporated in a crude evaporating pan on the claim is very pure and quite up to commercial standard.

The properties on Princess Royal Island, owned by the Surf Inlet Gold Mines, Limited, described in last year's report, and which were expected to produce this season, have not yet been equipped and made no output.

Portland Canal Mining Division.

As far as can be learned, there was no ore shipped from this division in 1913.

In the Glacier Creek section of the Bear River district, the properties are all awaiting the development of the 2,800-ft. tunnel being driven by the Portland Canal Tunnels Company. This tunnel had at the end of the year just struck the crush zone in which the ore was found 2,000 feet higher, but as yet no development has been done at the tunnel level.

No further development has taken place regarding the Red Cliff and no ore has been produced.

Mr. D. G. Forbes reported on the Salmon River claims for this Bureau, and considers that the present development gives substantial expectation of the development of large ore bodies of workable grade.

KIRKLAND LAKE AND PORCUPINE

Kirkland Lake Proprietary Limited.—The flotation of the Kirkland Lake Proprietary, Limited, in London, has aroused much interest. The prospectus has been criticized as being somewhat vague and indefinite in its terms. The company, according to the prospectus, secures under the contract the benefit of all arrangements now in course of negotiation, or which may hereafter be entered into, by Mr. Clement Albert Foster in regard to mining properties in this mining field or district, including the right to take the same over at cost price and free of any commission or profit to Mr. Foster. The purchase consideration for the above was $125,000. If the capital of the company is increased the vendor will get $5 in cash for every two shares issued up to 50,000.

The company has to date obtained control of the Tough-Oakes Gold Mines and the Sylvanite Mining Company, and has an option on the control of the Teck-Hughes Gold Mines. The Messrs. Tough and Oakes' interests in the the company were bought out and treasury stock was bought to an amount which gives a clear control. Treasury stock in the Sylvanite Mining Company, which holds the Wright Robbins claims, has been purchased. The company is now working both the Tough-Oakes and the Teck-Hughes mines. The shaft at the Tough-Oakes is to be sunk to the 300-ft. level at once, while drifts on the vein at both the 100 and 200-ft. levels are being prosecuted with vigor. Another compressor has been installed which will give considerable additional power. A shaft has been started on the No. 3 vein in the porphyry.

There is no difference in gold content per ton where the main vein is in the porphyry at the 200-ft. level.

There is no intention of erecting a larger mill until ore reserves have been developed to a much greater extent than at present. The last shipment of ore from the Tough-Oakes mine at Kirkland lake brings the total in gold contents to $60,084, and in silver $3,288. This does not include the gold bars produced in the mill. The fifth shipment, though made months ago, has not been settled for until quite recently. It ran slightly higher in gold than any of its predecessors and averaged much better to the ton in silver.

The total shipments totalled 131.55 tons and cover a period of a little over a year. All the ore shipped consists of vein matter alone.

Dome.—The December statement of the Dome mine shows that for the nine last months of 1913 the company milled 104,330 tons and produced $936,106 in bullion. The production for the month of December was 13,475 tons. Gold produced amounted to $106,904. The mill ran 90 per cent. of the possible time. For the nine months of April to December, inclusive, the Dome ore averaged $8.97 per ton recovered from the mill. May showed the highest grade per ton with $13.68, and August was lowest with $6.31. The ore averaged $7.93 in December.

Teck-Hughes.—The test shipment from the Teck-Hughes, Kirkland lake, ran 102 oz. in silver and $38.15 in gold. These samples were taken from the 100-ft. level of the No. 1 vein, where it was about 20 in. wide. The value of the silver content of the car surprised the company. The shipment consisted of four tons.

The drift on No. 3 vein has now been pushed for 125 ft. to the north at the 75-ft. level. The vein varies from 5 ft. to 18 in. in width. At the present time it is narrow in the face. The controlling interest in the Teck-Hughes is under option to the Kirkland Lake Proprietary Ltd.

Huronia.—An order has been placed for an additional five stamps for the five-stamp mill at the Huronia mine in Gauthier township. The addition includes also a tube

mill, three slimers, and other equipment. Development work has been suspended until the work on the power installation on Victoria creek has been completed.

COBALT, GOWGANDA, AND SOUTH LORRAIN

A three-year course in mining at the Haileybury High School, supported by the Provincial Government, is believed to be of considerable importance to the mining profession. It was adopted after a personal inspection of the situation by Dr. Merchant for the Board of Education and a guarantee that the Government would be favorable to finding support for the enterprise. It will, of course, have small beginnings. With the future of Northern Ontario as a mining country assured, there appears every probability of developing a school of mines. At the end of the three-year course a diploma will be given. At the present time the instructor whose salary will be paid by the Government, will devote his whole time to the classes formed. That there is a demand for this instruction is shown by the fact that already 18 pupils have been enrolled. The movement started with the voting of $5,000 for instruction in mining by the Board of Education. It was intended then that these classes should be conducted to enable men already working at the mines to attain some theoretical knowledge; but the classes formed were not a pronounced success as only a very few took advantage of the opportunities offered.

Nipissing.—Three new veins were encountered in the crosscut at the Nipissing's shaft No. 73, at the fourth level. This is believed to be a most important development as the finds were made in virgin territory. This crosscut is exploring the eastern portion of R. L. 400 opposite veins 64 and 73. Near the end of November this crosscut encountered three veins in a distance of 15 ft. All of them are about the same width, being from one to one and a half in. wide and assaying from 1,000 to 2,500 oz. They have a strike north and south and at the present time do not appear to be the extension of anything met with heretofore.

At shaft 64 the new vein encountered during November continues to show up well as drifting proceeds to the northeast. The vein assays 2,500 oz. over a width of 2 in. The main shaft now has a depth of 762 ft. There has been no change in the formation of the rock. The crosscut will be driven to the vein when the shaft has reached a depth of 900 ft.

Favorable developments were met with at shaft 86. The main vein is faulted between the first and second levels and the extension has just been found at the second level. The vein is 2 in. wide and assays 500 oz. The width and assay are satisfactory as development is in the Keewatin, and value should improve in the conglomerate.

The diamond drill is working in the diabase near the southern boundary of R. L. 408. No veins were encountered by the holes driven.

The high grade mill treated 161 tons and shipped 674,984 oz. of bullion. The low grade mill treated 6,268 tons.

During the month the company mined ore of an estimated net value of $164,794, and bullion was shipped from Nipissing and custom ore of an estimated net value of $399,999.

Ore Shipped to Hamburg.—The movement in direction of wider markets for the ore from Cobalt is apparently having some effect. In the past week both the Dominion Reduction Company and the Crown Reserve shipped to Hamburg. This is the first shipment of ore to Germany apart from the regular contract of the Crown Reserve with the kingdom of Saxony.

Cobalt in Demand.—There is now a good demand for ores with a low silver content and a high cobalt content in Europe owing to the success of various experiments with the metal. It has been found that cobalt will toughen steel, whereas nickel hardens it, and, for certain purposes, this is greatly to be desired. While Dr. Kalmus, who is making the experiments with cobalt at Kingston for the Department of Mines, denies that there is any definite economic result from his work, it has gone far enough to make him very optimistic of success. The price of cobalt has advanced considerably. As yet this rise in price has not affected many of the mines. Mines that ship raw ore or concentrate to the smelter still receive no returns for the by-product.

Downey Ships Ore.—The first important shipment of high grade ore from Elk Lake since 1910 came from the Downey property situated between Elk lake and Silver lake. The ore was taken out of an open cut by hand and is expected to run about 2,000 oz. to the ton. There is about ten tons of ore to be shipped. The property from which the silver was taken was in litigation for two or three years, and at the end of that time, as it was hard to raise capital, the owner decided to take out all the ore in sight in order to provide money for development.

The Miller Lake O'Brien Company at Gowganda is developing the property with great energy. The production now averages about 60,000 oz. a month.

The Mann mine on Gowganda lake is now sinking to the 200-ft. level with a view of raising up and blocking out ore. Another carload of high grade ore, which has been bagaged for the past six months, will be shipped soon. It is again stated that there is every probability that the property will be taken over by a British syndicate within a few months.

The Beaver Auxiliary, at Elk Lake has again been obliged to stop underground work owing to lack of water for the boilers. It is feared that the Cobalt Frontenac will also have to close down for a like reason. The Mapes Johnston has commenced the transfer of the machinery from the Montreal James, a defunct Hawthorne company, to the property.

The Mapes Johnston has been previously worked by hand. More rapid development will now be possible.

The Cobalt Aladdin, which is working the old Silver Queen on a lease, is now stoping a short shoot of ore which the former company overlooked. The shoot only has a length of 30 ft., with about the same depth in the conglomerate above the second level. It shows six inches of 1,400 oz. ore. Work in the Keewatin below the first and second levels has been abandoned. There are on hand now about 50 tons of high grade ore and concentrate. It is officially announced that 36,737 oz. of silver has been produced since the Aladdin Cobalt took over the lease.

Gould.—The shoot of ore found on the Gould proved to be quite short. It was found near the Seneca Superior line and was but 30 ft. long. The ore in sight is being stoped out and the winze sunk to the 250 ft. level.

Chambers-Ferland.—No. 4 shaft, which is being sunk on the northern portion of the Chambers-Ferland between the La Rose and Nipissing, has reached a depth of 300 ft. Within the next month a station will be cut at 350 ft. and crosscutting operations commenced. While this work is progressing the shaft will be taken down to the Keewatin contact.

WESTINGHOUSE MOTOR GIVES GOOD SERVICE IN A SALT MINE.

The accompanying view shows a Westinghouse motor which was recently removed from the mine of the Myles Salt Company on Avery Island, La., and sent in to be rewound, the motor having burned out after six years' continuous service.

Note the incrustation of salt in the pulley, around the terminals, and especially on the rotor fans and stator windings. Needless to say, a good deal of this salt was shaken off during transit, but in view of the water absorbing quantities of rock salt, there is sufficient remaining to indicate the conditions under which the motor was used.

SHUSHANNA MINING & TRADING CO.

The Financial Times, Montreal, says of this company: An advertisement, worded in extremely objectionable style, has been appearing in the columns of the Montreal Standard and other Canadian papers, urging the public to subscribe for the shares of the Shushanna Mining & Trading Co., Ltd., at 14 cents per share. Applications are to be addressed to the Aetna Investment & Trust Co., of Vancouver. In this connection it is important to remember that the laws of Vancouver permit the free use of the word "trust company" by organizations which are practically free from all inspection and control, and many of which are engaged in speculative business in realty and all kinds of get-rich-quick securities.

The advertisement, which closes with an application blank, includes a half-column of historical matter entitled "Millions in Mines," a quantity of "dope" about Shushanna which is certainly not in agreement with the reports of the Government experts, a few paragraphs on "the broad policy and the men behind the company" (naming, as usual, the reputable law firm which has no more responsibility than that of preparing the charter), and an article entitled, "An Assurance of Legitimate, Big Profits." It does not, however, contain one single word designating any properties, prospects, real estate, buildings, vehicles, trading business, or other assets owned or contracted for by the company, save and except the following:

"There is the already acquired mining property at Shushanna right in the heart of the discovery. Development work will commence on this as soon as weather conditions permit. The following contract has been entered into: Contract dated 8th October, 1913, between the Shushanna Mining & Trading Co., Ltd., and Michael L. McAllister, of Dawson. The company has transferred its properties at Shushanna to the Shushanna Gold Mines No. 1, in consideration for $500,000 to be paid in stock of the latter company." There is no statement of the terms on which these properties were acquired by the parent company, the valuation of the "prospect," or the total capitalization of "Gold Mines No. 1."

The officers of the company are "E. N. Winslow, capitalist; C. J. Stacey, director; J. W. Kager, field manager; H. C. Crumplin, secretary"; to which list is appended the names of the registrar, barristers and broker. There does not appear to be any good reason why these gentlemen should solicit the money of the Eastern Canadian public for so extremely hazardous and vaguely-described an adventure. We are assured that they are "well and favorably known in Vancouver," but there is no mention of any other and more serious financial or commercial organizations which have seen fit to employ their services. Our advice to all intending investors would be to go to Vancouver first, and, if possible, to Shushanna, and find out for themselves. They should remember that the Standard has already assisted in luring its readers into purchasing stock, of Standard Coal, Ruthven's railway-collision patents, and numerous other flotations which never had the smallest chance of yielding any returns—except to the promoters and the newspapers which divided the spoils.

COBALT ORE SHIPMENTS.

The shipments for the week ending January 23, were:

	High.	Low.	Total.
McKinley-Darragh	63,650	....	63,650
Townsite	84,700	....	84,700
Timiskaming	86,450	....	86,450
Casey Cobalt	59,085	....	59,085
	293,885	....	293,885

The bullion shipments for the week ending January 23 were:

	Bars.	Ounces.	Value.
Nipissing	76	92,439.10	$53,152.48
Dominion Reduction	35	39,585.00	22,771.00
Kerr Lake	18	8,462.75	4,167.22
Foster Lease Co.	3	2,187.25	1,141.44
Penn Can.	5	3,416.50	1,771.52
	129	146,090.60	$83,003.66

—Cobalt Nugget.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto, Ont.) January 23.

New York Curb.	Bid.	Ask.
Alaska Gold	23.12	21.37
British Copper	2.25	2.37
Braden Copper	7.75	7.87
California Oil	284.00	285.00
Chino Copper	41.50	42.00
Giroux Copper	1.00	1.50
Green Can.	40.00	43.00
Granby	81.00	86.00
Miami Copper	23.75	24.00
Nevada Copper	16.37	16.50
Ohio Oil	155.00	157.00
Ray Cons. Copper	19.12	19 25
Standard Oil of N. Y.	185.00	186.00
Standard Oil of N. J.	418.00	440.00
Standard Oil (old)	940.00	....
Tonopah Mining	7.12	7.25
Tonopah Belmont	7.75	8.00
Tonopah Merger	.63	.68
Inspiration Copper	16.50	16.75
Goldfield Cons.	1.62	1.87
Yukon Gold	2.37	2.50

Porcupine Stocks.	Bid.	Ask.
Apex	.01¼	.01½
Dome Extension	.07	.07¼
Dome Lake	.25	.25½
Dome Mines	17.75	18.00
Eldorado	....	.01
Foley O'Brien	.18	.19½
Hollinger	16.90	17.10
Jupiter	.08¼	.08½
McIntyre	1.00	1.25
Moneta	.02	.04
North Dome	....	.40
Northern Exploration	3.05	3.25
Pearl Lake	.09½	.09¾
Plenaurum	....	.50
Porcupine Gold	.11½	.12
Imperial	.01¾	.02¼
Porcupine Reserve	....	.06
Preston East Dome	.01¼	.01½
Rea	.20	.25
Standard	....	.01
Swastika	.04	.04½
United	....	.01
West Dome	.05	.11
Porcupine Crown	1.24	1.26
Teck Hughes	.20	.25

Cobalt Stocks.	Bid.	Ask.
Bailey	.06	.06¼
Beaver	.28	.29½
Buffalo	1.95	2.05
Chambers Ferland	.15	.15½
City of Cobalt	.30	.35
Cobalt Lake	.70	.75
Coniagas	7.30	7.50
Crown Reserve	1.94	1.96
Foster	.06	.08
Gifford	.03	.04
Gould	.02	.02¼
Great Northern	.10¼	.10
Hargraves	.02	.02½
Hudson Bay	70.00	75.00
Kerr Lake	4.95	5.00
La Rose	1.94	1.97
McKinley	1.20	1.25
Nipissing	7.90	8.00
Peterson Lake	.26½	.27
Right of Way	.04¾	.05¼
Leaf	.01	.02
Rochester	.02	.02¼
Cochrane	....	.40
Silver Queen	.05	.07
Timiskaming	.12½	.13
Trethewey	.24	.25
Wettlaufer	.06	.08
Seneca Superior	2.90	3.00

TORONTO MARKETS.

Jan. 26.—(Quotations from Canada Metal Co., Toronto):

Spelter, 5¼ cents per pound.
Lead, 5½ cents per pound.
Tin, 40 cents per pound.
Antimony, 8½ cents per pound.
Copper, casting, 15½ cents per pound.
Electrolytic, 15 cents per pound.
Ingot brass, 10 to 15 cents per pound.

Jan. 26.—Pig iron—(Quotations from Drummond, McCall & Co., Toronto):

Summerlee No. 1, $26.00 (f.o.b. Toronto).
Summerlee No. 2, $25.00 (f.o.b. Toronto).

Jan. 26.—Coal—(Quotations from Elias Rogers Co., Toronto):

Coal, bituminous, lump, $5.25 per ton.
Coal, anthracite, $8.25 per ton.

GENERAL MARKETS.

Coke.

Jan. 23.—Connellsville coke (f.o.b. ovens):

Furnace coke, prompt, $1.90 per ton.
Foundry coke, prompt, $2.40 to $2.65 per ton.

Jan. 23.—Tin, straits, 38.30 cents.
Copper, Prime Lake, 14.75 to 15.00 cents.
Electrolytic copper, 14.50 to 14.60 cents.
Copper wire, 15.75 cents.
Lead, 4.10 cents.
Spelter, 5.30 to 5.35 cents.
Sheet zinc (f.o.b. smelter), 7.25 cents.
Antimony, Cookson's, 7.25 cents.
Aluminum, 18.75 to 19.00 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $43.00 to $44.00 per ounce.
Platinum, hard, 10 per cent., $46.00 to $47.50 per ounce.
Platinum, hard, 20 per cent., $49.00 to $51.50 per ounce.
Bismuth, $1.95 to $2.15 per pound.
Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London. pence.
Jan. 13	57¾	26⅝
" 14	57¾	26⅝
" 15	57½	26½
" 16	57½	26½
" 17	57¾	26⅝
" 19	57⅝	26 9/16
" 20	57½	26½
" 21	57½	26½
" 22	57⅜	26 7/16
" 24	57⅝	26 9/16
" 26	57⅝	26 9/16
" 27	58	26¾
" 28	57⅝	26⅝

"Tested Packings for Every Purpose"

This pamphlet is an authentic text-book---a complete illustrated guide---to standard lines of tested packings.

We shall be glad to send you a copy, gratis.

Canadian Consolidated Rubber Company, Limited

MONTREAL

Please use this Coupon ☞

Canadian Consolidated Rubber Co., Ltd., Montreal.

Gentlemen :

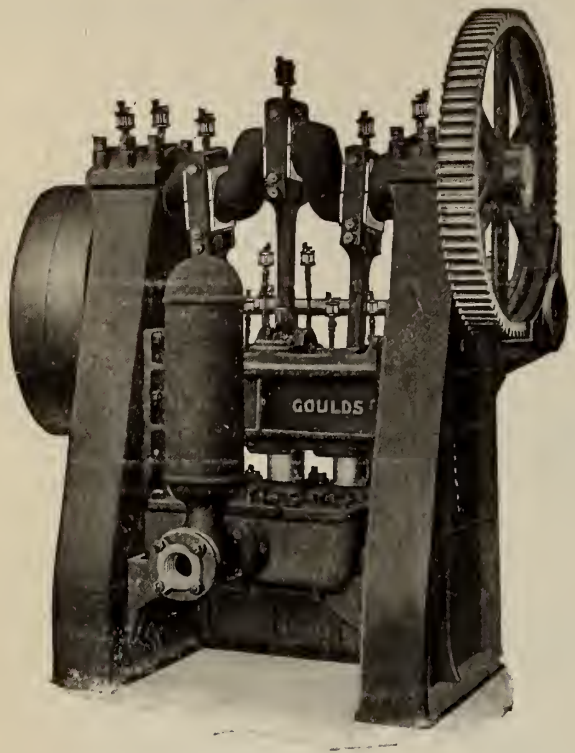
Please send me a complimentary copy of "Tested Packings for Every Purpose."

Name.....

Address.....

.....

C.M.J.



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam Shovels**: **Specially Flexible Ropes** for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:—

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, G. W.
Campbell & Deyel.
Carter, W. E. H.
Demorest, Stull & Low
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Forbes, H. L.
Graham, S. N.
Gwillim, J. C.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Leckie, J. E.
Loring, F. C.
McEvoy, Jas.
Scott, O. N.
Segsworth, Walter E.
Smith, Alex H.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.
Woolsey, W. J.

British Columbia

Ashworth, James
Fowler, S. S.

FOREIGN-New York

Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Campbell & Deyell
Heys, Thos. & Son.

Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd

Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASHWORTH, JAMES
MEMB. S. W. I. E.
Consulting Mining Engineer,
General Manager Crows Nest Pass Coal Co.
1909—1911
1109 Hornby St. VANCOUVER, B. C

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 5199, Code: Bedford McNeill

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place
New York City

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FORBES, H. L. M.Sc.,
Mining Engineer
77 Sparks Street., OTTAWA, CAN
Specialty: Mica Phosphate.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LECKIE, J. EDWARDS,
Mining & Consulting Engineer,
Box 1555. - - Vancouver, B.C.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY JAMES
Mining Engineer,
Stair Building,
TORONTO.

MACARTHUR, J. S. & CO.,
of LONDON & GLASGOW
Mining Engineers and Metallurgists,
PORCUPINE, ONT.
Represented by
Wm. Thornton, A. I. M. M.
Geo. P. Dempster.

MCMEEKIN, A., B. Sc. O. L. S.
Mining Engineer and Ontario Land Surveyor
Mines and Mining Properties examined and reported upon
KENORA - - ONTARIO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

O. N. SCOTT, B. Sc.
MINING ENGINEER
DOMINION BOND BUILDING
(*Cor. King and Yonge Sts.*) TORONTO
Tel. Main 1585 Cable Address "Onscott"

MAURICE W. SUMMERHAYES
Mining Engineer,
McENANEY MINES
Schumacher P.O., - Ont.

SMITH SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

THOMAS, KIRBY
Mining Engineer
Examination and Valuation of Mining Properties
20 Broad St., Suite 1017, Annex, New York
Cable Address: "Kirthom," New York.
Code: Bedford-McNeill.

WALKER, T. L.
Geologist
Reports on Molybdenum and Tungsten Properties.
University of Toronto, TORONTO

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

WANTED
Gold and Silver Prospects, Molybdenum, Tungsten, Mica, Graphite, Corundum.
Box 11
Can. Mining Journal

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

MINING PROPERTIES FOR SALE
Gold Mining Claims near Porcupine. A liberal proposition can be made to right parties, principals preferred. Information promptly given. Apply Box 99,
CANADIAN MINING JOURNAL
TORONTO

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

1085. Descriptive Sketch of the Geology and Economic Minerals of Canada. Accompanied by a geological and mineral map of Canada, by G. A. Young and R. W. Brock.
Guide Books to excursions of the International Geological Congress.
1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1165. Memoir No. 18. Bathurst District, New Brunswick, by G. A. Young. Maps not yet published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1220. Memoir 29. Oil and gas prospects of the Northwest Provinces of Canada, by Wyatt Malcolm.

BRITISH COLUMBIA

1206. Memoir No. 26. Geology and Mineral Resources of the Tulameen District, B.C., by Charles Camsell.
1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1042. Mineral Map of Canada. Scale 100 miles to 1 inch.
1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1208. Map 53A. Southeast Nova Scotia. Scale 4 miles to 1 inch.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
1300. Map 100A. Bell River, Quebec. Geology.

ONTARIO

1177. Map 31A. Larder Lake, Nipissing District, Ontario. Geology.
1244. Map 64A. Advance geological copy of map of Gowganda Mining Division and vicinity.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.
1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.
1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.
1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1195. Map 45A. Tulameen, Yale District, British Columbia. Topography.
1196. Map 46A. Tulameen, Yale District, British Columbia. Geology.
1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.
1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.
1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.
1304. Map 106A. Groundhog coal field, British Columbia. Geology.
1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

YUKON and NORTH WEST TERRITORIES

1089. Map 9A. Explored routes on parts of the Albany, Severn and Winisk Rivers. Scale 8 miles to 1 inch.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

WATERWORKS PUMPS

High Duty Horizontal Compound and Vertical Triple Expansion

PUMPING ENGINES

Capacities from One-Half Million to Thirty Million Gallons per twenty-four hours

Specifications on Request

The John Inglis Co.,
LIMITED

Boilermakers and Engineers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL. 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF . . . . . **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Pefinery at Deloro, Ontario

Branch Office : 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of

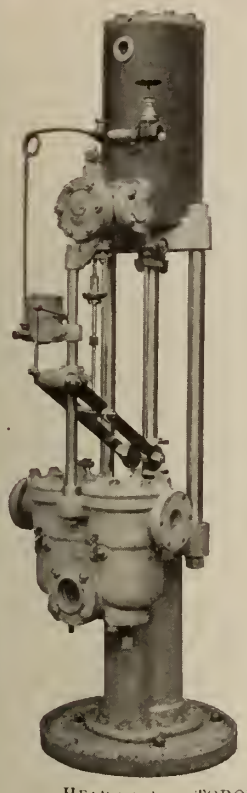
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

POSITION WANTED

Mechanical Construction Engineer and Draughtsman, experienced Designer and Erector of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc., seeks position. References.

Apply Box 8,
CANADIAN MINING JOURNAL, Toronto



Mather & Platt Pumps

FOR ALL PURPOSES

A Mather & Platt Patent Vertical, Direct-Acting Steam Pumps for Boiler Feeding purposes, suitable for 200 lbs. pressure.

Note slow speed, long steady stroke; roller bearings on motion levers; patent group valves; gun metal lined water cylinders; water pistons fitted with ebonite rings; pumps made in sizes from 810 to 10,000 imp. gallons per hour.

SIZE ILLUSTRATED, 8 x 6 x 18.

CANADIAN ALLIS-CHALMERS, LIMITED

HEAD OFFICE: TORONTO. DISTRICT SALES OFFICES: MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER, PRINCE RUPERT.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $10 an acre for SUPERIOR METALS when more than 20 miles distant from a railway and $20 an acre when less than 20 miles.

For INFERIOR METALS the prices are $2.00 and $4.00 an acre respectively.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co..... 22
Amatite Roofing 13
American Diamond Rock Drill Co. 16
Ashworth, James. 23
Astley, J. W..... 23

B

Bartlett, C. O., & Snow Co..... 17
Bath, Henry & Son..... 28
Beatty, M. & Sons, Ltd..... 11
Bennet, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons..... 16
Blackwell, Geo. G., Sons & Co.... 28
British Columbia, Province of.... 18

C

Canadian Allis-Chalmers, Ltd. ... 29
Campbell & Deyell..... ..23 and 25
Canadian Bag Co..... 13
Canadian Bank of Commerce..... 8
Canadian Cleveland Drill Co..... 9
Canadian Copper Co..... 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Laboratories, Ltd..... 25
Canadian Northern Steamships ... 7
Canadian Ingersoll-Rand Co., Ltd. 3
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Capell Fan Co..... 16
Carter & Smith..... 23
Castellanos, A. W..... 16
Cohen, S. W..... 23
Colvocoresses, G. M..... 23
Consolidated Mining & Smelting Co. 28
Coniagas Reduction Co., Ltd..... 28
Curtis's & Harvey.....
.....Outside back cover
Can. Consolidated Rubber Co., Ltd. 21

D

Dept. of Mines, Canada..... 26
Delnro Mining & Reduction Co.... 28
DePencier, H. P..... 23
Diamond Drill Contracting Co.... 16
Dominion Coal Co., Ltd..... 8
Dominion Bridge Co..... 16
Donald, Dr. J. T..... 25
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W..... 23

F

Ferrier, W. F..... 23
Fleck, Alex. 7
Flory, S., Mfg. Co..... 12
Forbes, H. L..... 24
Forbes, D. L. H..... 23
Fowler, S. S..... 23
Fraser & Chalmers, Ltd..... 4
Federal Engineering Co., Ltd. ... 31

G

Graham, S. N..... 23
Gray, John. 25
Greening, B., Wire Co., Ltd..... 10
Gwillim, J. C..... 23

H

Hadfield's Steel Foundry Co. 6
Handley, John. 24
Hardman, J. E..... 24
Hassan, A. A. 23
Haultain, H. E. T..... 24
Hersey, Milton Co., Ltd..... 25
Heys, Thos. & Son..... 25
Hille, F. 24
Holman Drill Co..... 20

I

Inglis, John & Co., Ltd..... 27
Imperial Bank of Canada 2
Industrial & Technical Press..... 39
Industrial & Technical Press 14
International Nickel Co. 8
Ltd. 11

J

James Ore Concentrator Co.....
.....Outside back cover
Jeffrey Mfg. Co., Ltd. 19
Johnson, W. S..... 24
Jones & Glassco..... 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co..... 25
Leckie, J. Edwards..... 24
Legg Brothers 35
Loring, F. C..... 24
Lymans, Limited. 9
Lands of the Algoma Central and Hudson Bay Ry..... 36

M

Morton, B. K. & Co..... 18
MacArthur, J. S..... 24
McEvoy, James 24
McMeekin, A. 25
Mussens, Limited. . . ..
.....20 and front cover
Michigan College of Mines 7

N

Nova Scotia Steel & Coal Co..... 10
Nova Scotia, Province of..... 15
Northern Canada Supply Co., Ltd. 7
Northern Electric & Mfg. Co., Ltd. 5

O

Orenstein-Arthur Koppel Co..... 5
Oxford Copper Co. 8
Ontario, Province of 30

P

Paterson Mfg. Co..... 13
Peacock Bros. 6
Pyke, Jas. W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31

S

Stanley, W. F. & Co., Ltd..... 12
Schaaf-Regelman, E. 28
Scott, O. N. 24
Segsworth, W. E..... 24
Smart-Turner Machine Co..... 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd.....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Sullivan Machinery Co..... 2
Summerhayes, Maurice W..... 24
Swedish Steel & Importing Co., Ltd. 12
Standard Underground Cable Co. of Canada, Ltd. 15

T

Toronto University 2
Tyrrell, J. B..... 24
Thomas, Kirby 24

W

Waterous Engine Works Co., Ltd. 9
Willmott, A. B..... 24
Walker Bros. 6

Lanco Balata Belting

This belt has no equal in service giving qualities where the conditions change from wet to dry. It is equally reliable for all conditions except those of heat. It is made intensely strong and is impregnated by our own secret process with PURE balata gum. Write for booklet "The Main Drive."

Federal Engineering Co., Limited
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt, Ont.
Ledoux & Co., 99 John St., New York.
Thos. Hayes & Son, 124 onge St., Toronto.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Bags—
Canadian Bag Co., Ltd.
Smart-Woods, Ltd.

Ball Mills—
Canadian Alis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Mussens, Limited.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried.A. G., Germany.
Mussens, Limited.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Limited.
Northern Canada Supply Co.
Jones & Glassco.
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineers Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd.
Thomas & William Smith.
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada), Limited.
Mussens, Limited.
Northern Canada Supply Co.

Blowers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried.A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.

Boilers
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
Canadian Ingersoll-Rand Co., Ltd.
The John Inglis Co., Ltd.

Buckets—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Limited.
Northern Canada Supply Co.

Buildings—Steel Frame
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd.

Cable — Aerial and Underground—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Limited.
Mussens, Limited.

Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Limited.
Northern Canada Supply Co.

Cables—Wire—
Standard Underground Cable Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.

Carriers—
The Herbert Morris Crane & Hoist Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co

Case Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Cement Machinery—
Canadian Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.

Chains—
Jeffrey Mfg. Co.
Peacock Brothers.
Jones & Glassco.
Mussens, Limited.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.

Chain, Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell.
Thos. Heys & Son.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Limited.

Coal Handling Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd

Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Limited.
Peacock Brothers.

Compressors—Air—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd.
Laurie & Lamb.
Canadian Westinghouse.
Can. Ingersoll-Rand Co., Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Canadian Allis-Chalmers, Ltd.
Peacocks Brothers.
Mussens, Limited.
Northern Canada Supply Co.

Condensers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Brothers.
Laurie & Lamb.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.

Conveyors—Belt—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Brothers.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Waterous Engine Works.
Canadian Fairbanks-Morse. Co., Ltd.

Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
SmartTurner Machine Co.
Peacock Brothers.
Mussens, Limited.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany.

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Gantry—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Hand Power—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Lymans, Limited.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Hadfields Steel Foundry Co.

Cyanide Plants—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Roessler & Hasslacher.
Mussens, Limited.
Thomas & William Smith.
Peacock Brothers.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Limited.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons.
Mussens, Limited.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Brothers.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Standard Diamond Drill Co.

Drills—Diamond.
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Canadian Ingersoll-Rand Co.
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Siemens Co. of Can., Ltd.
Canadian Ingersoll-Rand Co.

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Limited.
Orenstein-Arthur Koppel Co.

Dynamite—
Curtis & Harvey (Canada). Limited.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Limited.
Peacock Brothers.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Elevators—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Peacock Brothers.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Brothers.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Brothers.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Mussens, Limited.
Alex. Fieck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Brothers.
M. Beatty & Sons.
Canadian Westinghouse.
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Brothers.
The John Englis Co., Ltd.
Can. Fairbanks-Morse Co.

Engines—Oil—
Peacock Brothers.
Can. Fairbanks-Morse Co.

Engines—Steam—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Mahine Co.
Robb Engineering Co.
S. Flory Mfg. Co.
Alex. Fleck.
Peacock Bros.
M. Beatty & Sons.
Laurie & Lamb.
Mussens, Limited.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Brothers.
Mussens, Limited.

Feeders—Ore—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Mussens, Limited.

Filters—
Krupp, Fried, A. G., Germany.

Friction Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co. Ltd.

Forgings—
M. Beatty & Sons.
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Brothers.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA : - - - - - - Halifax
QUEBEC : - - - - - - Montreal
ONTARIO : Toronto, Cobalt, South Porcupine, Port Arthur, Kingston
MANITOBA : - - - - - - Winnipeg
ALBERTA : - - - - - - - Edmonton
BRITISH COLUMBIA : Vancouver, Victoria, Nelson, Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krupp, Fried, A. G., Germany.
Lymans, Limited.
Mussens, Limited.

Fuse—
Peacock Brothers.
Curtis & Harvey, (Canada). Limited.
Canadian Westinghouse.
Canadian Explosives.
Mussens, Limited.
Northern Canada Supply Co.

Gears—
Canadian Westinghouse.
Krupp, Fried, A. G., Germany.
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada., Ltd.

Girders—Steel—
Dominion Bridge Co.

Gravity Lowering Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Hangers—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Heaters—Feed Water—
Mussens, Limited.
Laurie & Lamb.
Canadian Westinghouse.
Peacock Brothers.
Fraser & Chalmers, Ltd.

High Speed Steel Twist Drills—
Mussens, Limited.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co. Ltd
Peacock Brothers.
Krupp, Fried, A. G., Germany.
Mussens Limited.
Canadian Allis-Chalmers, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
Waterous Engine Works.
M. Beatty & Sons.
Can. Fairbanks-Morse Co.
Fraser & Chalmers Ltd.
Northern Canada Supply Co.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Canadian Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Limited.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Can. Cleveland Drill Co.
Northern Canada Supply Co.

Jacks—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Canadian Allis-Chalmers, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Limited.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Lamps—Sofety—
Canadian Explosives.
Peacock Brothers.
Ackroyd & Best.
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works.
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—electric—
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Siemens Co. of Can., Ltd.

Locomotives—Steam—
Mussens, Limited.
Canadian Westinghouse.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Ore Sacks—
Can. Bag Co.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining & Smelting Co. of Canada.
Krupp, Fried, A. G., Germany.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Limited.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Peacock Brothers.

Pipes—Rivetted—
Consolidated Mining & Smelting Co.
Peacock Brothers.
Laurie & Lamb.
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.

Pipe Fittings—
Can. H. W. Johns-Manville.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Westinghouse.
Northern Canada Supply Co.

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Brothers.
Jones & Glassco.

Producer—Gas—
Krupp, Fried. A.G., Germany.
Mussens, Limited.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
Smart-Turner Machine Co.
Krupp, Fried. A.G., Germany.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.
Laurie & Lamb.
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Canadian Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Alex. Fleck.
Mussens, Limited.
Smart-Turner Machine Co.
Peacock Brothers.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Pneumotic—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Can. Ingersoll-Rand Co.

Pumps—Steam—
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
Alex. Fleck.
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A.G., Germany.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Rolling Mill Machinery—
Krupp, Fried. A.G., Germany.

Rolls—Crushing—
Mussens, Limited.
Krupp, Fried. A.G., Germany.
Fraser & Chalmers, Ltd.
Canadian Allis-Chalmers, Ltd

Roofing—
Patterson Mfg. Co.
Dominion Bridge Co.
Mussens, Limited.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories.
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A.G., Germany.
Thos. Hays & Sons.

Screens—
Mussens, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Self Landing, Self Delivery Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Smart-Turner Machine Co.
Peacock Brothers.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany.

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shavels—Steam—
Mussens, Limited.
M. Beatty & Sons.

Slime Tables—
Diester Concentrator Co.
James Ore Concentrator.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Smelting Machinery—
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Can. Allis-Chalmers.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drill—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A. G., Germany.
Canadian Ingersoll-Rand Co. Ltd.
Peacock Brothers.
Swedish Steel & Imp. Co, Ltd

Steel—Tool—
Mussens, Limited.
Thos. & Wm. Smith.
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co, Ltd

Surveying Instruments—
Peacock Brothers.
W. F. Stanley.
C. L. Berger.

Switchboards—
Canadian Westinghouse.
Can, Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Limited.
Krupp, Fried. A. G., Germany,
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Limited.
B. Greening Wire Co.
Can. Allis-Chalmers Ltd

Transformers—
Canadian Westinghouse.
Can. Fairbanks-Morse Co.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Transits—
C. L. Berger & Sons.
W. F. Stanley.
Peacock Brothers.

Tractors—Oil—
Canadian Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse.
Peacock Brothers.
Laurie & Lamb.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.
Krupp, Fried. A. G., Germany,
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Winding Engines—
Waterous Engine Works.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Can. Ingersoll-Rand Co., Ltd.
Fraser Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Wire Cloth—
Can. Allis-Chalmers, Ltd.
Mussens, Limited.
Northern Canada Supply Co.
B. Greening Wire Co.

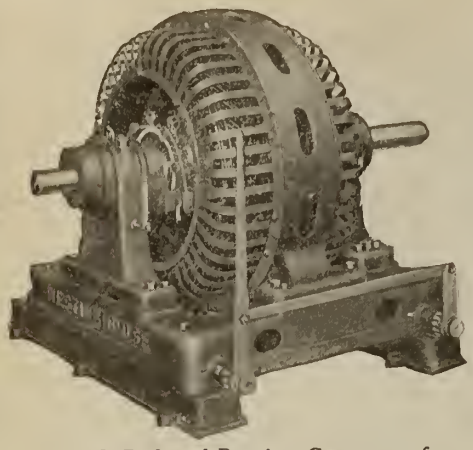
Wire (Bare and Insulated)—
Standard Underground Cable Co. of Canada, Ltd.

Wire—Magnet—
Standard Underground Cable Co. of Canada. Ltd.

Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

LEGG BROS
ENGRAVING CO.
DESIGNING ENGRAVING
5 JORDAN ST
TORONTO CANADA

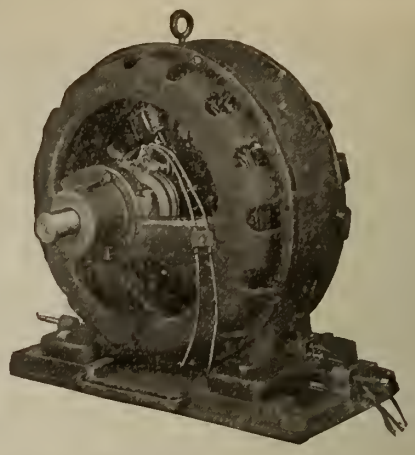


Type G Pedestal-Bearing Generator for Capacities exceeding 75 kva.

The Most Popular Line of Belted Alternating Current Generators on the Market To-Day.

Westinghouse Type G

Built in capacities of 30 to 200 Kva, they are daily demonstrating to several hundred well satisfied customers their ability for long and hard service.



Type G Bracket-Bearing Generator for Capacities of 75 kva and smaller

They are cool even at heavy overloads and at low-power factors.

They are fitted with "damper" windings (except 30 and 50 kva sizes), and are, therefore, ideal for gas and oil-engine drive.

The bearings are of ample proportions, self-oiling and supported in an adequate manner, as shown in the accompanying illustrations.

Send for Descriptive Leaflet 2389

They have a simple, easily operated belt tightening mechanism.

They are as efficient as a machine of their capacity and type could well be, and are thoroughly reliable.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

— FOR REGULATIONS, MAPS, ETC., APPLY TO —

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M.A.

May be had at any bookstall, 5c. the copy, and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— *Published by* —

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

— *which also publishes* —

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

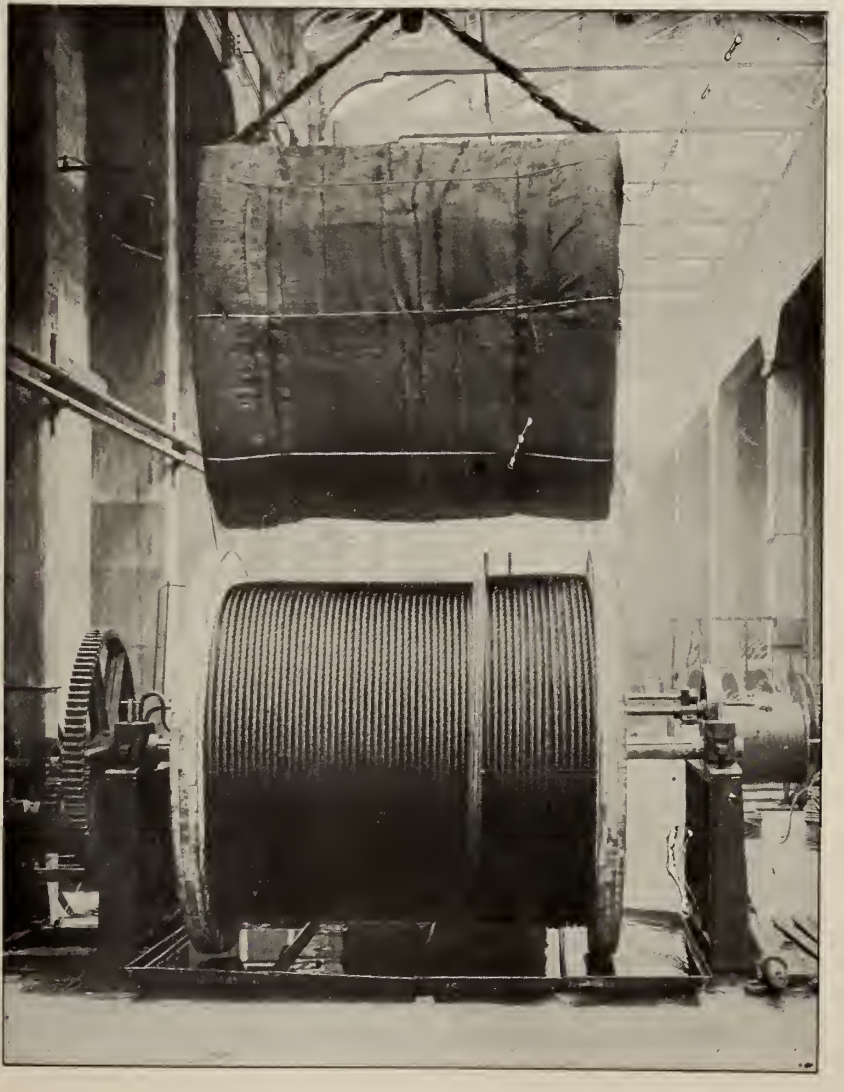
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For MINING:—
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

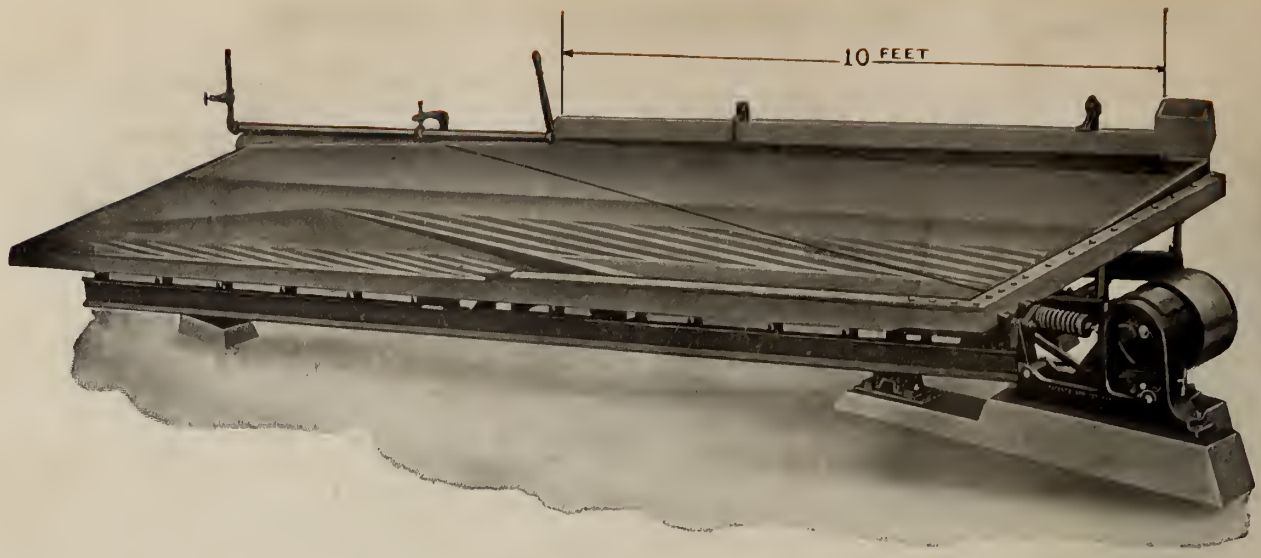
MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.



The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

True Economy Demands

CURTIS'S & HARVEY'S

Best Quality Only

EXPLOSIVES

400 St. James St.
MONTREAL

Royal Exchange Bldg.
COBALT

FEBRUARY 15, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 4

Put the HARDY on your Pay Roll

The Hardy Simplex Hammer Drill

Will prove to be the Best Wage Earner on Your Job.

It will drill in any rock faster than any hand hammer drill on the market, and will be more economical.

TWO SIZES

B6—For all Ordinary Rock Work

B7—For the Very Hardest of Rocks

Automatic Air Feeds for Stoping, Columns for Drifting, etc., and Dust Allayers Supplied When Necessary. Carried in Stock.

MUSSENS LIMITED

MONTREAL, 318 St. James St. TORONTO, 155 West Richmond St. COBALT, Opp. Right of Way Mine WINNIPEG, 259-261 Stanley St. CALGARY, 10th Ave. and 3rd St. E.

VANCOUVER 101 Water St. QUEBEC 31 St. Louis St. ST. JOHN, N.B. 57 Symthe St. HALIFAX 78 Granville St.

BYERS GENUINE WROUGHT IRON PIPE
FULL WEIGHT GUARANTEED

The first step. Taking iron ore from one of the Byers mines

The ore steamer A. M. Byers. Built and owned by Byers to carry ore from mines to blast furnaces

Blast furnace owned and operated by Byers to produce the Byers pig

In one of the Byers rolling mills. Skelp passing from the furnace to the welding rolls

Byers pipe and coupling showing the Byers Mark on each

THERE'S one standard of quality kept flawless for fifty years, wrought into every length of Byers Wrought Iron Pipe. This standard has no counterpart in pipe history; in pipe manufacture to-day, or in the records of pipe service.

Its maintenance through years of steady growth of output long ago necessitated Byers ownership of ore mines; Byers ore steamers; Byers blast furnaces for the production of every ton of pig iron used; Byers puddling furnaces for converting the pig into muck bar, and only this Byers muck bar enters the Byers rolling mills to be made into Byers Genuine Wrought Iron Pipe.

All is Byers—independent of every outside manufacturing condition. A complete chain of interlocking operations, absolutely free from any factor of service or resource other than those of Byers.

Never has a ton of scrap entered a Byers gate.

Never has Byers marketed a length of pipe that was not of the highest attainable quality and full weight guaranteed.

And the present status of Byers—after a period of achievement whose history covers fifty years—is one of ever gaining volume, with highest efficiency of operation and equipment in all pipe making experience.

Such is the Byers record and standard.

All men who know the remarkable service of Byers Pipe, including those who know only by common report and not by actual experience, will have even greater appreciation of Byers quality through their knowledge of these facts concerning the Byers ideals and manufacturing history.

When purchasing Byers Pipe, always look for the Byers marking on each length and coupling. It is the A and Z of pipe service assurance.

Write for Byers' Book—"The Control of Quality in Every Process." It gives some interesting and valuable pipe information.

A. M. BYERS COMPANY

ESTABLISHED 1864

PITTSBURGH - PENNSYLVANIA

District Agents at

New York City	Chicago	Detroit	Columbus	Louisville	Denver	Portland, Ore.	Birmingham	Jacksonville
Boston	Buffalo	Cincinnati	Dayton	St. Louis	San Francisco	Wheeling	Savannah	Philadelphia
	Cleveland	Canton	Toledo	Indianapolis	Los Angeles	New Orleans	Tampa	

Write for the name of the Byers dealer in your district. He can supply you immediately.

Kennedy Tube Mill

¶ This cut represents a 7 foot x 22 foot Kennedy Tube Mill. It is of the heaviest construction throughout, insuring rigidity and accurate alignment in its bearings and the maximum capacity, as the more rigid the mass of material is held in contact with the falling pebbles or steel balls, the more work is accomplished.

¶ This Mill is noted for its simplicity, there being but few parts to get out of order.

¶ It is the only Mill that has absolutely a perfect adjustable feeder, where the quantities fed to the mill can be regulated from one to seventy-five or more tons per hour.

¶ These Mills are made for wet or dry grinding.

Additional information furnished upon request.

Full line of Kennedy Heavy duty Machinery, including :—
Gyratory, Roll Hammer and Jaw Crushers,
Revolving and Pulsating Screens, etc.

FJAB ROCK DRILL STEEL

Hollow and Solid. **Reliable and Economical.**

SEND US A TRIAL ORDER

Rock & Power Machinery

Limited

P. H. MOORE - General Manager

HEAD OFFICE : 12 King St. East, Toronto. Ont.

Exclusive Agents in Canada for the Kennedy Manufacturing and Engineering Co., and the Ottumwa Hoists.

BRANCH OFFICES :

VANCOUVER ; CALGARY ; WINNIPEG ; SUDBURY ;
COBALT ; OTTAWA ; MONTREAL ; HALIFAX,
AND IN THE KING EDWARD HOTEL, TORONTO

Imperial Bank
of Canada

Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Paid Up	6,925,000
Reserve and Undivided Profits	8,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

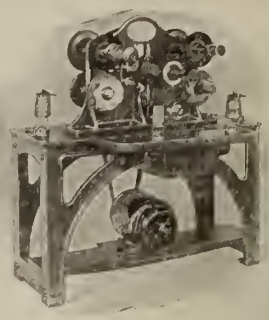
Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

SAFETY LAMPS AND LAMP CLEANING MACHINES to clean over 100 lamps per hour. Fitted with small engine or motor. Compact, strong and simple.

All kinds of Lamps and Appliances.



Ackroyd & Best, Ltd.

The world's Safety Lamp Experts

MORLEY, - LEEDS, ENGLAND

For full particulars apply

ACKROYD & BEST, LTD.

No. 2 Arrott Power Buildings, Barker Place, Pittsburgh, Pa., U.S.A.

Telephone Nos. { P. & A. Tel. Main 2217 / Bell Grant 1619

UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

For Calendar and other information apply to the Secretary.

A. T. LAING

How Wide is Your Vein ?

Will it widen or pinch out? Is it faulted, and how badly? Is it richer or leaner at depth?

SULLIVAN "H" DIAMOND DRILL
Owned by Baikanour Mines, Ural Mountain District, Russia.

These, and a dozen similar questions of the first importance to mine owners, can be answered most quickly and accurately by the consistent use of a

Sullivan Diamond Core Drill

(The Standard of Accurate Prospecting for 40 years)

WE CARRY IN STOCK

Sullivan Diamond Drills ranging in capacity from 300 feet to 6500 feet; drills for surface or underground work; drills for operation by steam, air, electricity, gasoline engine, hand power, horsepower, or belt.

WE ARE CONTRACTORS

for diamond drill work, and solicit your prospecting on the basis of an agreed price per foot. Modern outfits and skilled operators always ready. We go anywhere for work (now running five drills in central Asia. See photo).

Ask for our prices on drills and drilling.

Bulletin 665 A.

Air Compressors Rock Drills Hoists

SULLIVAN MACHINERY CO.

122 SOUTH MICHIGAN AVE.
CHICAGO

MONTREAL COBALT NELSON VANCOUVER

THE JACKHAMER

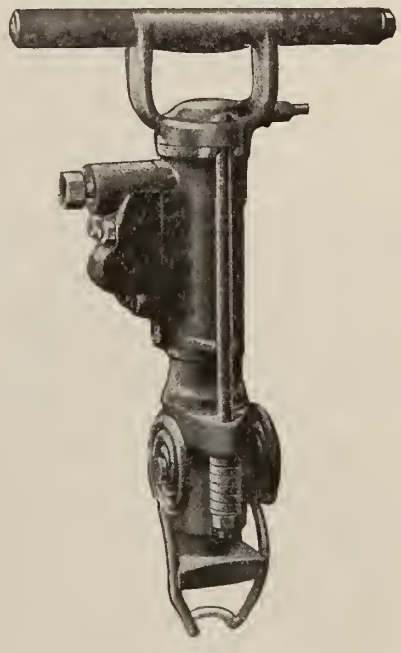
IS SELF-ROTATING, SELF-LUBRICATING, AND IT IS AN ALL-STEEL DRILL OPERATED BY STEAM OR AIR.

In the "JACKHAMER" are those qualities so essential to the low cost of drilling rock.

The all-steel construction with the automatic lubrication protects users against excessive repair costs because the parts are all practically indestructible and are automatically given proper oiling.

As to drilling costs, the "JACKHAMER" has a great advantage over the mounted drills, inasmuch as a wide range of drilling records show that from 40 to 60 per cent. of drilling time with piston machines is consumed in changing holes, setting up, etc.

Whereas, with the "JACKHAMER" from 80 to 95 per cent. of the drilling time is consumed in actual drilling, with the result that the "JACKHAMER" is very materially reducing drilling costs. It is also being universally accepted as an improved method over the heavier machines for work to which it is applicable.



The Jackhamer—
Used extensively for sinking and down holes of moderate depth.

A "JACKHAMER" USER SAYS:

"Just a line re those Plug Drillers we got from you for our Little Rapids Mine. They have been running steadily for the past nine months, drilling in very hard rock most of the time, and up to date have not cost us one cent for repairs, and made it possible to work that Pit to a profit, which I do not think could be done otherwise. Wishing you all the compliments of the season."

Send for Pamphlet K-68 which describes the JACKHAMER.

CANADIAN INGERSOLL-RAND CO., LIMITED.

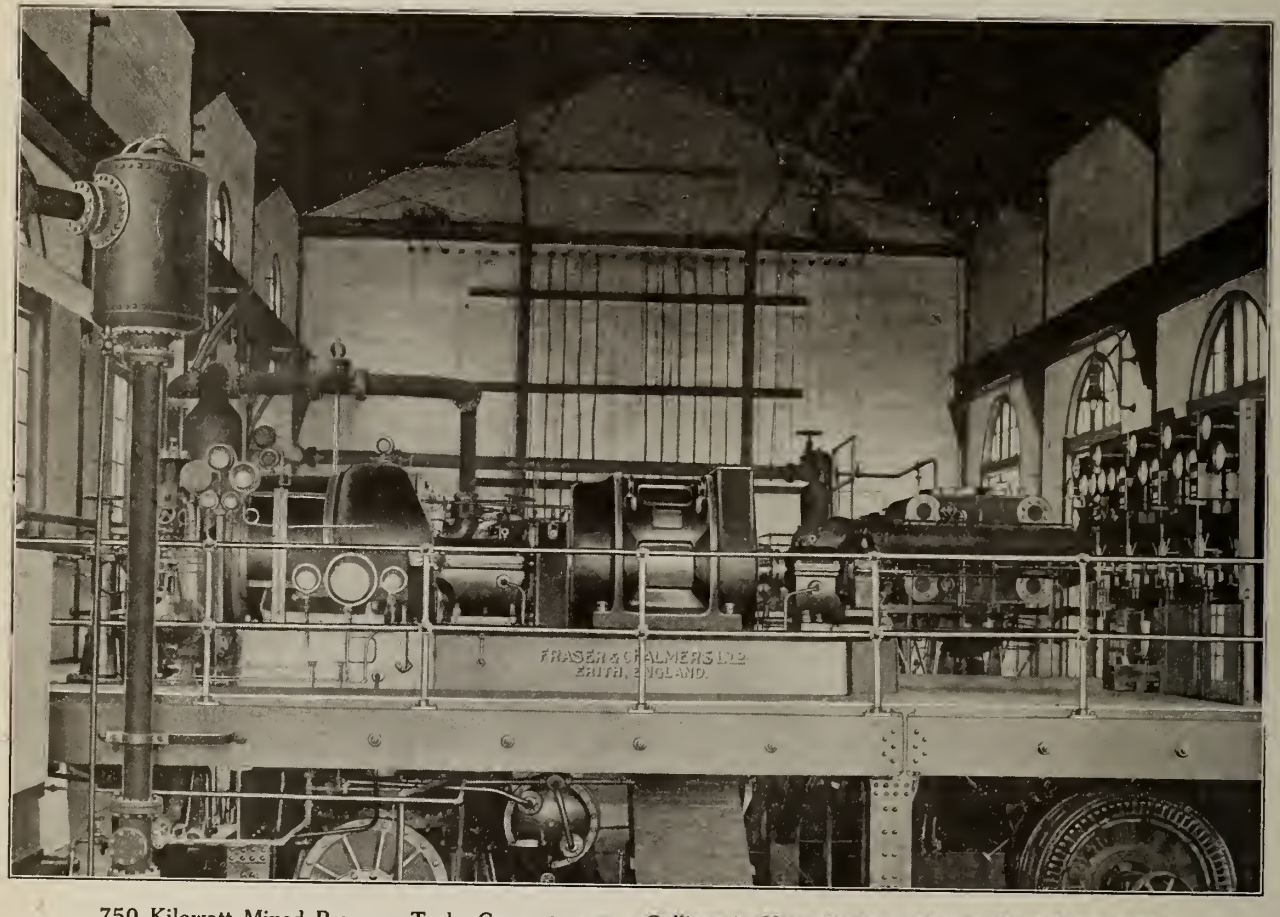
COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

IS YOUR GENERATING EQUIPMENT OVERLOADED?

Why not utilize the exhaust steam from your winding engines and fans to produce additional electric power.



750 Kilowatt Mixed Pressure Turbo-Generator, at a Colliery in Nova Scotia, utilizing the exhaust steam from two Compound Engines.

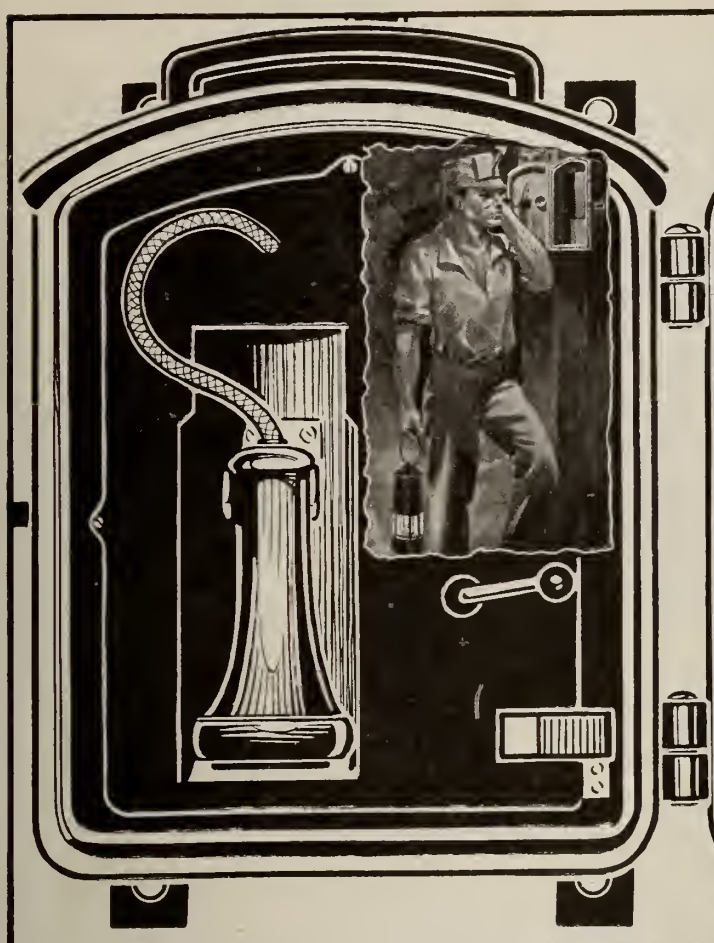
With our simplified mixed pressure governing gear, no heat accumulator is necessary to efficiently use an intermittent supply of exhaust steam.

FRASER & CHALMERS

LIMITED

Canadian Branch :

4 PHILLIPS PLACE - - - - - MONTREAL, P.Q.



MINE TELEPHONES

Bring every part of the mine into instant communication.

In emergency, warning can be flashed to every part.

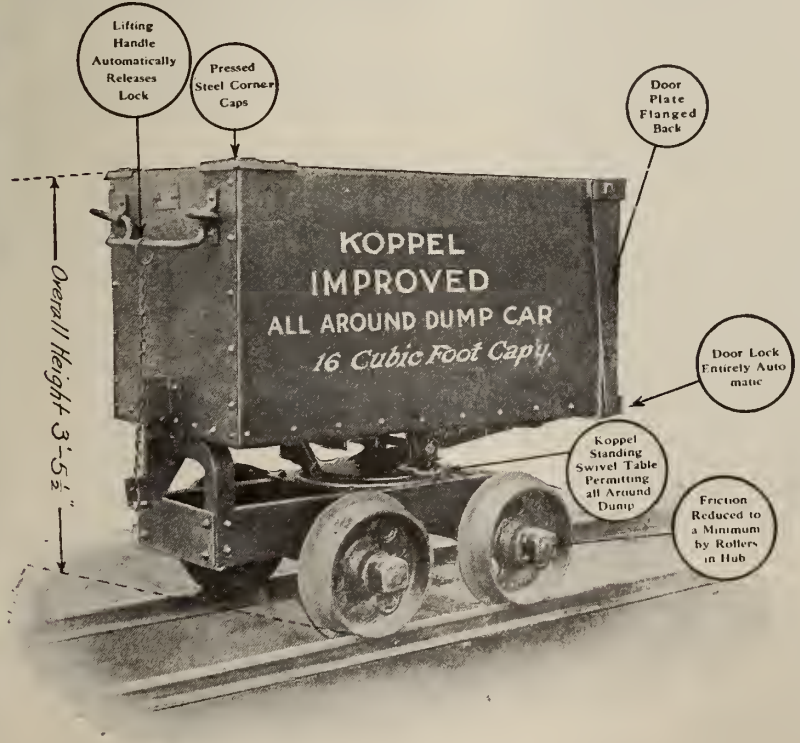
Even under ordinary conditions it is invaluable changing the mine from a number of disjointed departments isolated by distance, to a compact organization working together with the greatest efficiency under the one head.

Our nearest house will gladly send a man to tell you all about Northern Electric Mine Telephones.

THE Northern Electric AND MANUFACTURING CO. LIMITED

Montreal	Winnipeg	Edmonton
Halifax	Regina	Vancouver
Toronto	Calgary	Victoria

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Capy.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

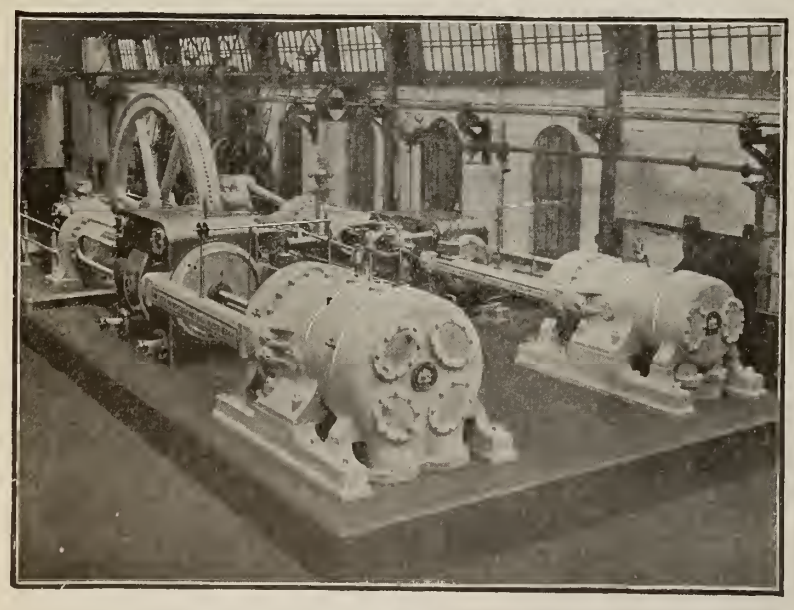
SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

THE SUPREME METAL
FOR WEARING PARTS

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON **MICHIGAN**

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal

or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.

and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

The Canadian Bank of Commerce

PAID-UP CAPITAL, $15,000,000
RESERVE - - 13,500,000

DRAFTS ON FOREIGN COUNTRIES

Arrangements have recently been completed under which the branches of this Bank are able to issue Drafts on the principal points in the following countries.

Austria-Hungary	Fr'ch Cochin-China	Norway
Belgium	Germany	Persia
Brazil	Great Britain	Phillipine Islands
Bulgaria	Greece	Roumania
Ceylon	Holland	Russia
China	Iceland	Servia
Crete	India	Siam
Denmark	Ireland	South Africa
Egypt	Italy	Straits Settlements
Faroe Islands	Japan	Sweden
Finland	Java	Switzerland
Formosa	Manchuria	Turkey
France	Mexico	West Indies and elsewhere

No Delay in Issuing. Full Particulars on Application.

American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages*, 6x9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

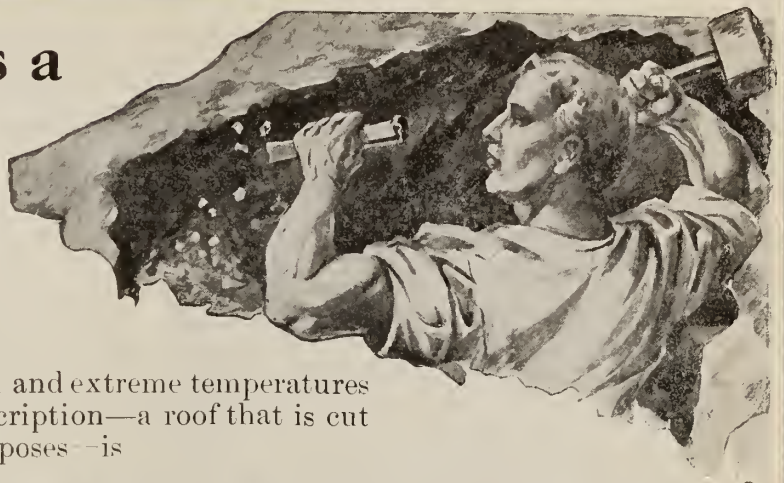
43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

As Permanent As a Roof Cut Out of Solid Rock



Can you imagine anything more durable than a roof cut out of solid rock! Such a roof would be practically **indestructible.** Fire couldn't burn it. Acid fumes, gases, rain, snow, sun and extreme temperatures couldn't injure it. A roof of this description—a roof that is cut from solid rock to all intents and purposes—is

J-M ASBESTOS ROOFING

This roofing is made by crushing solid Asbestos Rock and compressing the long fibres into a dense, homogeneous felt. Several layers of this rock felt are then permanently cemented together with Nature's greatest water-proofer, Trinidad Lake Asphalt, making a light-weight roofing that is virtually a **solid sheet of pliable stone.**

J-M Asbestos Roofing forever rids you from the expense of repairs. **No coating. No gravelling. Everlasting.** After more than a quarter-century of service J-M Asbestos Roofing shows no signs of deterioration. It is the cheapest of all roofings from the cost-per-year standpoint. Adapted to any building and any climate. Easily and quickly applied.

J-M Roofing Cleats, packed in each roll, make absolutely watertight laps and give the entire roof a handsome white appearance. If your dealer can't supply you, we will ship direct.

Write our nearest branch for sample of the Asbestos Rock from which this roofing is made, and Illustrated Catalog.

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos Roofings, Pipe Coverings, Conduit, Metallic Hose. "ASBESTOS." Waterproofing, Mastic Flooring, Stack Lining, Packings, Boiler Preservative, etc.

TORONTO MONTREAL WINNIPEG VANCOUVER 1931

SARTORIUS BALANCE

MODEL

"AMERICA"

WRITE FOR DESCRIPTIVE CIRCULAR

LYMANS, LIMITED

MONTREAL

Different

kinds of work require different tools —we make a specialty of

Stope Drills

only, and know that our continuous efforts to produce the most efficient and most economical Stope Drill on the market have met with wonderful success.

The "Cleveland"

receives universal praise wherever it is seen or tried. Can we send you an equipment for 30 days' trial?

Fully described in Bulletin No. 30

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED

Successors to

The Canadian Cleveland Drill Co.
Limited

80 Duchess Street - TORONTO

GREENING'S WIRE ROPE

Our Mining Ropes are especially constructed to suit the requirements for HOISTING or HAULING.

Crucible Cast Steel
Best Plow, Acme Brand,
extra high breaking strain for deep shafts.

Regular Lay Lang's Lay

Wire Rope Fittings
Wire Rope Grease

ASK FOR OUR ROPE CATALOGUE

The
B. Greening Wire Co.
Limited

Hamilton, Ont. - Montreal, Que.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 1 4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, NOVA SCOTIA

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Won't this ROBB

MINE HOISTING ENGINE

just suit you ?

Two Robb-Armstrong side-crank engines, 22 inches diameter by 42 inches stroke. Engine bearings hard babbit.

Two Drums 8 feet in diameter, 58 inches wide. Bronze sleeves.

New, complete, with steam brake, steam-operated clutch, throttle valve, etc.

FULLY GUARANTEED.

For Photos, Drawings, etc., write to

International Engineering Works Limited
AMHERST, N.S.

Transportation Building. Montreal
Traders Bank Building, Toronto
39-49

"BEATTY"

Material Handling Plant

Hoisting Engines
Clamshell Buckets
Steel Derricks
Derrick Irons
Centrifugal Pumps
Dipper Dredges
Steel Scows, Etc.

Your requirements for anything in this line can be promptly filled by us, for we have a big stock of finished plant ready for immediate shipment, so are in fine shape to serve you.

Let us know your needs—we can interest you.

M. BEATTY & SONS, Limited
WELLAND, ONTARIO

AGENTS:
H. E. Plant, 1790 St. James St., Montreal.
H. W. Petrie, Ltd., Toronto
E. Leonard & Sons, St. John, N.B.
R. Hamilton & Co., Vancouver
A. R. Williams Machinery Co., Winnipeg

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records
Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

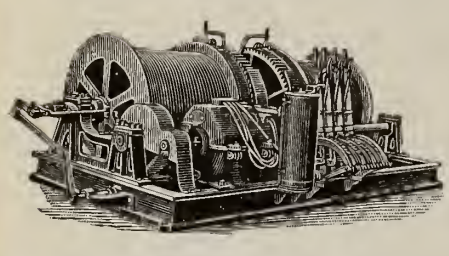
HEAD OFFICE AND FACTORY TORONTO BRANCH FACTORIES WINNIPEG AND MONTREAL

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

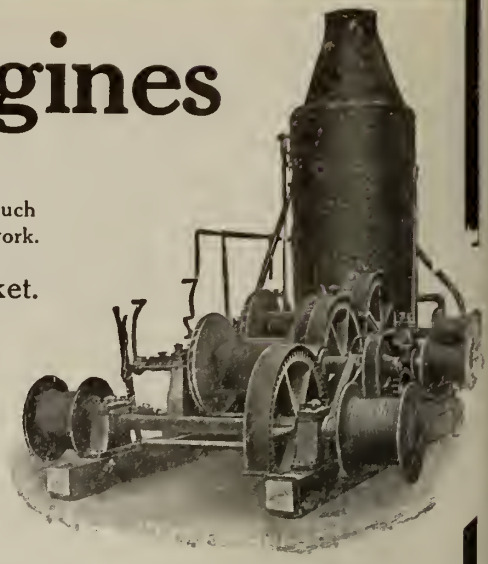


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



ASK FOR OUR CATALOGUES

S. Flory Mfg. Co.

Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

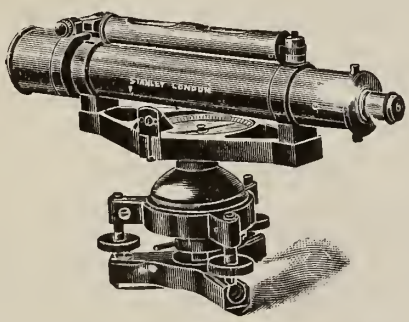
SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade **STANLEY** Mark

The largest manufacturers of

Surveying and Drawing Instruments

in the world.



"Stanley Quick-Setting-Up Level"

Please send for our K 35 Catalogue (post and duty free) and compare our prices with those of other first-class makers.

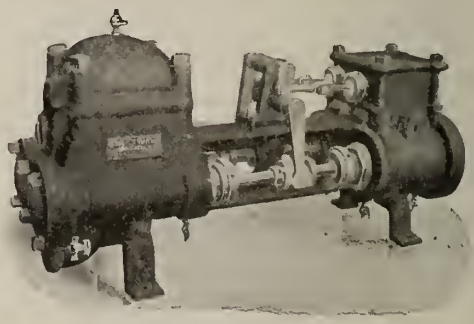
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, London, W.C.

Head Office and Showrooms:

286, High Holborn, London, England

Do You Want High Class Pumping Machinery at Reasonable Prices?



If so, write

The Smart Turner Machine Co.
LIMITED

Hamilton, Canada

BAGS!

Jute Cotton Duck

FOR

ASBESTOS COAL ORE

CONCENTRATES

FLOUR GRAIN FEED

PRINTING A SPECIALTY

The Canadian Bag Company Limited

Head Office: Montreal

TORONTO WINNIPEG

Amatite ROOFING

Figure It Out Yourself!

THE proposition is so simple that it hardly needs figuring. It is simply this: Most of the ready roofings on the market have a smooth surface which *requires painting every year or two.*

Amatite has a real mineral surface that *needs no painting.*

The cost is about the same.

If you buy a roofing that needs painting, you must figure on the expense of paint and the labor. If you neglect to paint it the roof soon falls apart.

Anyone who will spend a few moments investigating the proposition cannot help but decide on Amatite. Sample and booklets free on request.

THE PATERSON MFG. CO., Limited

Montreal, Toronto, Winnipeg, Vancouver, St. John, N.B., Halifax, N.S. Sydney, N.S.

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets. Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

All Ready!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

THE JOURNAL OF COMMERCE WITH WHICH IS INCORPORATED The Shareholder

TWO of the oldest and most reliable Weekly Journals, recently amalgamated to strengthen the work heretofore done by each in the field of Commerce, Finance, Insurance and Industry. Editor, *J. C. Ross, M.A.*

Canada's greatest asset is her natural resources and the commodities by which she is best known are the products of industries engaged in the development of these resources. Canadian ASBESTOS, NICKEL and COBALT control the Markets of the world for these commodities, while her SILVER, PULP and PAPER, and GRAIN and GRAIN PRODUCTS are dominant factors of the world's supplies. The only Periodicals which are devoted entirely to these industries are :

CANADIAN MINING JOURNAL, published twice a month. Editor, *Reginald E. Hore, B.A.*

PULP AND PAPER MAGAZINE OF CANADA, published twice a month. Editor, *A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST, published once a month. Editor, *J. G. Adams, B.A.*

CANADIAN TEXTILE JOURNAL, a monthly periodical devoted entirely to Textile Manufacturing, is published from the same Offices. Editor, *E. Stanley Bates.*

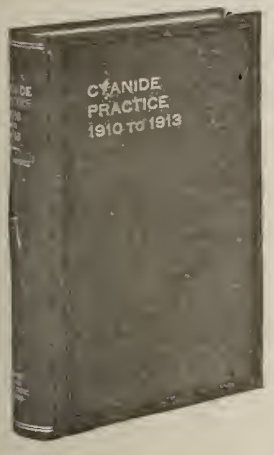
In addition to publishing the above mentioned Journals, we are especially equipped to do all kinds of

FINE BOOK, CATALOGUE AND JOB PRINTING

MONTREAL OFFICE
Industrial and Educational Press, Limited
Read Building

TORONTO OFFICE:
Industrial and Technical Press, Limited
44-46 Lombard St.

CYANIDE PRACTICE
1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.

140 illustrations

Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings:

Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

Let us send you this new Bulletin

It is filled with valuable information for the buyer and user of cable terminals. There are tables of dimensions, weights, voltages, etc., that should be in your files. Note carefully the following:

Table of Contents

General Descriptfon of D. S. Terminals.
Regular Types of D. S. Terminals.
Inner Seal Terminals.
Wiped Joints vs. Clamped Joints.
Separation and Insulation of Conductors.
Insulating Compounds.
Terminals for Ordinary Service.
Terminals for Special Service.
Instructions for Ordering and Installing.

A card to our nearest office will bring your copy of this book. Write now.

Standard Underground Cable Co. of Canada, Limited

Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, for all purposes, also Cable Accessories.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

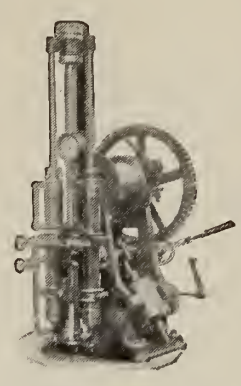
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

The Capell Patent Fans

UNDER IMPROVED PATENTS

1,600 Mine Fans in use.
Highest Water Gauges and Largest Outputs.

All enquiries to

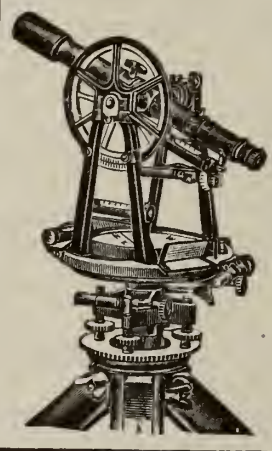
THE CAPELL FAN CO.

13 MOSBY ST., NEWCASTLE-ON-TYNE, ENGLAND

POSITION WANTED

Mechanical Construction Engineer and Draughtsman, experienced Designer and Erector of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc., seeks position. References.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto



C. L. BERGER & SONS

37 Williams Street

BOSTON, - MASS.

SPECIALTIES:

Standard Instruments and Appliances for Mining, Subway, Sewer and Tunnel, and all kinds of Underground work.

SEND FOR CATALOGUE

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.

MORRIS CHAIN-BLOCKS,
DUST-PROOF,
WEATHER-PROOF,
FOOL-PROOF.

THE HERBERT MORRIS CRANE & HOIST CO., LIMITED,

EMPRESS WORKS,
PETER STREET,
TORONTO, ONT.

BRANCH OFFICE,
CORISTINE BLDG.,
MONTREAL, QUE.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

—SEND FOR CATALOGUE—

STANDARD DIAMOND DRILL CO.

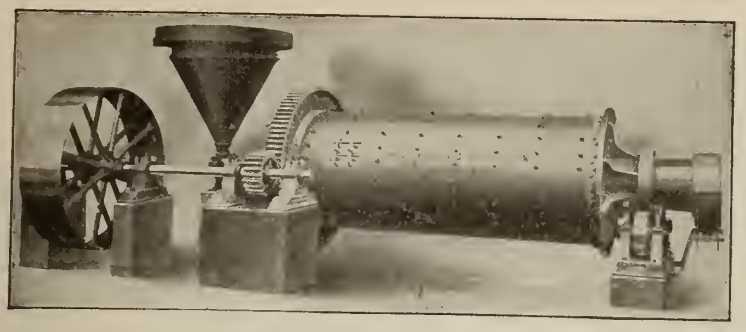
745 First National Bank Building, CHICAGO, U.S.A.

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK



Wet Grinding Tube Mill

COMPLETE INSTALLATIONS
for the
TREATMENT of ORES of EVERY KIND
especially GOLD ORES

Chemical and Metallurgical Laboratories.

Large Experimental Works equipped with full sized machines for Crushing and Ore Concentration.

FRIED. KRUPP A.-G. GRUSONWERK
Magdeburg (Germany)

Canadian Representatives:
Jas. W. Pyke & Co., Limited, 232 St. James St., Montreal

KRUPP
CRUSHING, CONCENTRATING & SMELTING MACHINERY:

Amalgamating Pans
Amalgam Presses
Ball Mills
Bucket Wheels
Bullion Furnaces
Chilian Mills
Clean-up Pans
Concentrating Tables
Conveyors
Cyanide Plants
Edge Runners
Electro-magnetic Ore Separators
Grizzlies
Rotary Crushers
Jigs
Mercury Traps
Picking Tables
Retorts
Roasting Furnaces
Rolls
Scoop Wheels
Screens
Settlers
Slime Tables
Smelting Furnaces
Sorting Belts
Spitzlutten
Stamp Mills
Stone Breakers
Trommels
Tube Mills

COMPRESSORS
FOR MINING WORK
LOW INITIAL COST LOW MAINTENANCE CHARGES
Manufactured by Belliss & Morcom, Ltd., England
LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.
MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

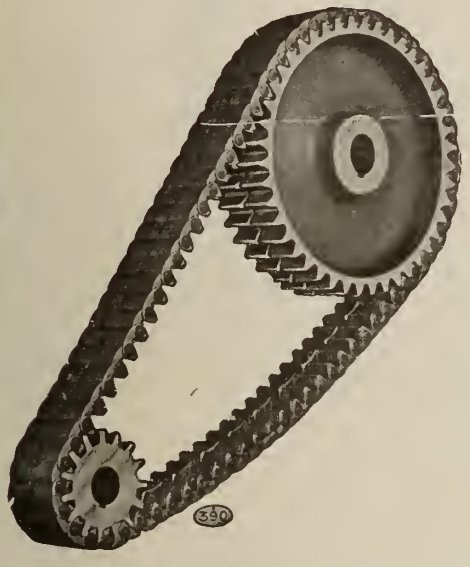
B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD (PATENT) SILENT CHAINS



Regularly applied for driving:—

Chilian Mills	Fans	Rolls
Crushers	Blowers	Stamp Mills
Deister Tables	Jigs	Lineshafts
Elevators	Pumps	Haulages, etc.

Renold Chain runs either Forward or Backward, Fast or Slow, is not affected by Heat, Cold or Moisture, and is particularly Suitable to Short Centres.

Write for Catalogue and Particulars. Chains and Repairs stocked in Montreal.

JONES & GLASSCO, (REG'D) Engineers

Sole Canadian Agents

Branch Office, Toronto. 49 Place D'Youville, MONTREAL

RENOLD PATENT SILENT CHAINS

GOLD

Its Geological Occurrence and Geographical Distribution

By MALCOLM MACLAREN

This is an excellent treatise, carefully written by a well-known authority on gold deposits.

It is the most comprehensive work on the subject, and contains authentic descriptions of gold deposits in all parts of the world.

Accuracy and brevity are notable features.

The volume is well printed and contains 278 illustrations.

The price is $7.50.

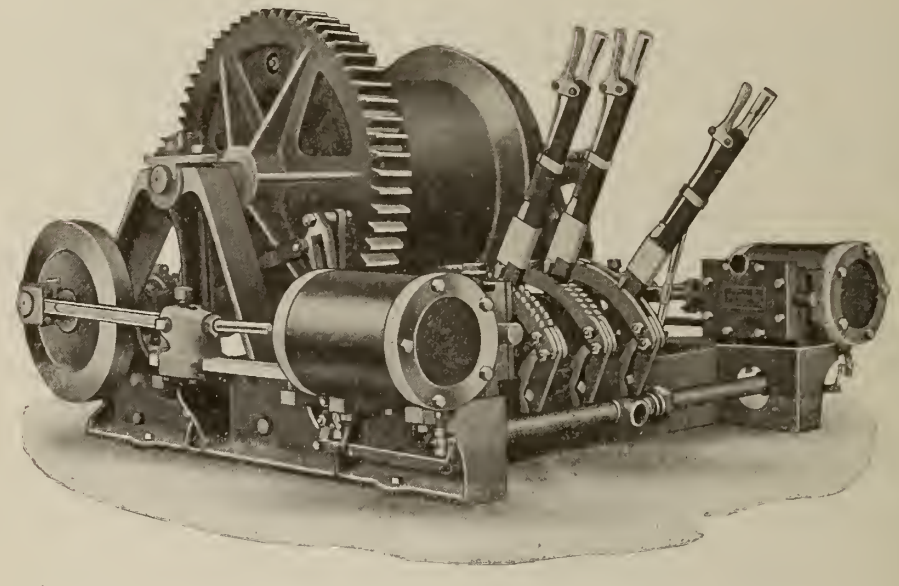
Book Department, Canadian Mining Journal

44-46 Lombard Street, Toronto

HOISTS

STEAM AND ELECTRIC

for Mines, Quarries and Contractors, etc.



All of our hoists are absolutely first-class.
They contain the best of workmanship and material.

ALL SIZES **ALL STYLES**

CATALOGUE SENT ON REQUEST

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, February 15, 1914. No. 4

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 34B Board of Trade Building
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

	Page
Editorial—	
Annual Meeting Canadian Mining Institute	109
Kirkland Lake	109
Increased Production at the Dome	110
Hollinger Gold Mines Report	110
Granby Company's Methods of Mining and Smelting at Phoenix and Grand Forks, B.C.	113
The International Geological Congress, by H. Mortimer-Lamb	120
Hollinger Gold Mines, Annual Report, 1913	121
The Successful Treatment of Zinc Sulphide Ores, by Frank L. Wilson	127
Canadian Northern Railway Mount Royal Tunnel, by D. J. O'Rourke	128
The Late R. G. Leckie	136
The Late J. D. Sword	137
Personal and General	139
Special Correspondence	140
Markets	148

ANNUAL MEETING CANADIAN MINING INSTITUTE

The sixteenth annual meeting of the Canadian Mining Institute will be held in Montreal on Wednesday, Thursday and Friday, March 4th, 5th and 6th. It is announced that Dr. Edward D. Peters, metallurgist, and Mr. Gardner F. Williams, mining engineer, have been invited to attend as guests of the Institute. Dr. Peters has consented to address the Institute on the subject of "The Production of Heat in Metallurgical Furnaces." Mr. Williams, if he is able to attend, will give some account of the Kimberley diamond mines.

A preliminary list of papers promised for the meeting was published in our last issue.

The attention of members is directed to the announcement that the Institute's rooms at the Windsor Hotel have been vacated. The office is now at the Ritz-Carlton.

The meetings of the Canadian Mining Institute are always interesting and well worth attending.

KIRKLAND LAKE

Numerous comments are being made on the flotation in London of a company organized to conduct mining operations in the gold field at Kirkland lake, Ontario.

The comments are not very complimentary and there appears to be reason for some of the criticism.

The readers of the Canadian Mining Journal are aware that a very promising new gold field is being opened up in Ontario. In our issue of July 15 some account was given of the gold deposits and the results obtained at the Tough-Oakes mine. Since that date our special correspondent, Mr. Ben Hughes, has several times reported the progress at the mine. Our readers have been advised that the Tough-Oakes is a rich little mine, with good prospects. The shaft has been deepened to 200 ft. and short drifts run east and west at the 100 ft. and 200 ft. levels. The vein is very thin, only a few inches, but rich. The reports given out indicate that much of the wall rock for the width of the drifts contains gold in paying quantities. A recent report by Manager Charles O'Connell shows that the development has continued to be satisfactory, and indicates that the ore blocked out by the work thus far done can be mined at a handsome profit. Mr. O'Connell states that the ore taken out in making the openings has more than paid for the cost of development. Such a statement makes it clear that the ore is unusually rich and that the mine will probably be a very profitable one.

In England, however, the prosperous condition of the Tough-Oakes mine is, according to the critics, being ex-

aggerated: The public has been invited to buy shares in a company which has control of valuable property; but which has a large capitalization. It is as yet an exploratory and development company rather than a mining company.

The critics should bear in mind that the properties have been as yet only slightly explored. The one vein which has been developed to any extent has proven remarkably rich. There are other veins which are regarded by the former owners as very promising.

A real basis for criticism is to be found in the optimistic advertisements published by the company. There is confusion of probabilities and actualities. The advertisements are likely to give the public a false impression.

There is every indication that the Tough-Oakes property will be an important producer of gold when developed and equipped. There is a good chance of neighboring properties proving up well. It is fortunate for the district that a strong company has been formed to explore and develop the properties. Investors should, however, be advised of the fact that the actual value of the ore blocked out is small in comparison with the price of shares.

Those who are willing to assume the risks of the venture, knowing the facts, need no guardian. Mining men will distinguish between ore reserves and "probable" and "possible" ore. They will examine the properties themselves, or have them examined, before investing large amounts. There are many who are willing to take the risks. It will be unfortunate if stock is purchased by anyone who is under the impression that the company's properties have been very extensively explored or that there are as yet any large producing mines in the Kirkland Lake district. There is one rich little ore body which may prove on further development to be a large one. Concerning the value of other deposits very little is yet known.

Ontario has in the Kirkland Lake district an important addition to the known mineral resources of the Province. The development of the district is greatly to be desired. The prospects are good. It is to be hoped that those who do not understand the risks, the very great chance of many of the deposits proving unprofitable after money has been expended on them, will leave the development to those who do understand the conditions and who, understanding, are willing to take a chance.

INCREASED PRODUCTION AT THE DOME

During the past few months the production of the Dome mill has been very considerably increased. The plant was designed to treat about 350 tons; but, without increasing the number of stamps, the mill superintendent has raised the output to over 450 tons. The results obtained are very creditable to Mr. W. F. Battersby, who has been in the employ of the company since the beginning of the operations, and who was appointed mill superintendent last fall.

HOLLINGER GOLD MINES REPORT

The third annual report of Hollinger Gold Mines, Limited, has been issued, and extracts from it will be found in this issue of the Journal. The main facts as to production, costs and profits have been given throughout the year in four-weekly statements. In the annual report the facts given in these periodical reports are summarized and commented upon. Much other interesting information, including maps of the mine workings and estimates of ore reserves is given.

It will be recalled that in November, 1912, there occurred a strike among the miners at the Hollinger, and that the mine was operated under adverse conditions for some months. While the strike was ill-advised and unsuccessful, the company suffered considerably from the conditions brought about by the agitators. The general manager reports, however, that the final result has proven satisfactory, as the new men who displaced the strikers are doing better work than did the dissatisfied miners. The tonnage now being mined per man is greater than before the strike.

Throughout the year there has been a gradual improvement in the total costs per ton.

Mr. Robbins shows that successful results have been obtained in treating the ore. He intimates that the company is still considering the advisability of using a continuous decantation process, and states that the mill is now being extended to permit of a larger tonnage being treated.

The report is accompanied by plans of each of the four levels and by stope sections of several of the veins, and is of such a character as to give the shareholders a good idea of the condition of the property, of what has been done and of what may be expected. It is a credit to the directors and to the general manager.

CANADIAN MINING INSTITUTE.

The following nominations have been received for offices falling vacant at the close of the annual meeting 1914:

For President:

Mr. G. G. S. Lindsey, Toronto, Ont.

For Vice-President:

Mr. Chas. Fergie, Montreal, Que.
Mr. W. F. Sutton, Victoria, B.C.

For Councillors:

Mr. D. B. Dowling, Ottawa, Ont.
Mr. Norman R. Fisher, Cobalt, Ont.
Mr. John E. Hardman, Montreal, Que.
Mr. W. S. Johnson, Montreal, Que.
Mr. J. J. Penhale, Sherbrooke, Que.
Mr. M. E. Purcell, Rossland, B.C.
Mr. J. W. Pyke, Montreal, Que.
Mr. C. E. Smith, Toronto, Ont.
Mr. P. A. Robbins, Porcupine, Ont.
Mr. O. E. S. Whiteside, Coleman, Alta.

Council 1914.

The Council during the year 1914 will be constituted, therefore, as follows:

Past Presidents:

Dr. W. G. Miller, Toronto, Ont.
Dr. F. D. Adams, Montreal, Que.
Dr. A. E. Barlow, Montreal, Que.

President:
Mr. G. G. S. Lindsey, Toronto, Ont.

Vice-Presidents:
Mr. Thos. Cantley, New Glasgow, N.S.
Mr. Chas. Fergie, Montreal, Que.
Mr. W. J. Sutton, Victoria, B.C.
(One vacancy to be filled at Annual Meeting.)

Councillors:
Mr. M. B. Baker, Kingston, Ont.
Dr. J. A. Bancroft, Montreal, Que.
Mr. R. W. Brock, Ottawa, Ont.
Mr. D. H. Browne, New York, N.Y.
Mr. E. T. Corkill, Copper Cliff, Ont.
Mr. T. Denis, Quebec, Que.
Mr. D. B. Dowling, Ottawa, Ont.
Mr. E. Dulieux, Montreal, Que.
Mr. Norman R. Fisher, Cobalt, Ont.
Mr. J. E. Hardman, Montreal, Que.
Mr. W. S. Johnson, Montreal, Que.
Mr. J. McEvoy, Toronto, Ont.
Mr. J. J. Penhale, Sherbrooke, Que.
Mr. M. E. Purcell, Rossland, B.C.
Mr. J. W. Pyke, Montreal, Que.
Mr. P. A. Robbins, Porcupine, Ont.
Mr. C. E. Smith, Toronto, Ont.
Mr. L. Stockett, Calgary, Alta.
Mr. O. E. S. Whiteside, Coleman, Alta.
Mr. W. A. Williams, Grand Forks, B.C.

NIPISSING.

N. Y., Feb. 11.—President Earle of Nipissing Mines Co. will send this statement to shareholders:

The annual report for 1913 will be sent to shareholders in April, and will contain full particulars concerning operations for the year and condition as of Jan. 1, 1914, but as there has been of late a falling off in net earnings, due to the lower average grade of ore produced, and as it is impossible for the management to state whether this condition will prove temporary or permanent, it is deemed best to submit a brief statement.

The nature of the ore bodies in the Cobalt district is such that it is not possible to predict earnings in advance. It is, however, well known that mining costs increase with the development and gradual extraction of ore bodies.

The earnings will in future, as they have in the past, depend on the continuation of the veins now known and being operated, and the discovery of new ore bodies.

There have been periods in the past when earnings have fallen off because of conditions similar to those that now exist.

The company holds a large area of undeveloped territory, which presumably contains ore bodies of value.

Your management has confidence in the value of your property and will continue to make to shareholders the largest possible returns compatible with economical operations and proper development.

In carrying out this policy, distributions to shareholders in the past eight years have amounted to $11,340,000.

N. Y.—Supplementing statement by Pres. Earle of Nipissing it has been learned that during the past three months Superintendent Watson has, in the course of development work, encountered five new veins, eight inches in width and assaying about 2,000 oz. of silver per ton of ore.

These veins were first struck near the third level, or at a depth of between 200 and 300 feet. Stoping has not begun as yet, so that the extent of these ore bodies has not been ascertained. The discoveries were all in practically new ground.

Ore reserves on Jan. 1, 1914, were practically unchanged from the 9,600,000 oz. reported on Jan. 1, 1913. This indicates that for every ounce of ore extracted during the year, another ounce was put in its place.—Boston News Bureau.

INTERNATIONAL NICKEL.

N. Y.—Practically all 3,000 shares of International Nickel Co. common stock, voting trust certificates, offered for subscription to employees and officers at 110, have been subscribed for. Of the 4,000 persons on the payroll about 40% subscribed for their allotment of shares.

The right to subscribe expired on Jan. 31. The minimum subscription was one share to any employee of under five years' service and receiving up to $825 yearly, while the maximum subscription was ten shares to any one receiving over $4,033 who had been in the employ of the company over ten years.

Officers and employees will pay for their subscriptions in monthly instalments, receiving dividends on the stock as soon as first instalment is paid, and receiving an extra compensation equal to 5% on the stock paid for, payable annually to such employees as retain their stock and remain in employ of the company. The first deduction as payment for the stock allotted will be made on the February salary or wages.

The management of International Nickel Co. is highly gratified with the result of the offering.

PETERSON LAKE.

Mr. R. B. Lamb, who has just returned to Toronto from the property at Cobalt reports to the president of the Peterson Lake Mining Company as follows:

During the past ten days we have been drifting on No. 7 vein, shaft No. 2 on Peterson Lake, and we had assays up to 140 oz. per ton.

On the 7th of February we encountered a cross vein striking north east and south west which intersected No.7 (striking east and west). Beyond this point we encountered high grade ore in two veins on the right side of the drift. For a width of about three and one-half inches the ore will assay 3,500 oz. to the ton. The cross vein is four inches wide of good ore. Altogether the drift shows about six inches of ore which will average over 2,300 oz. to the ton. The drift is all in mill ore, which should average over fifty oz. to the ton.

We are only thirty feet into conglomerate and the ore is improving every round. I think it is an ore shoot and not a pocket. The rock is hard, compact conglomerate. I estimate that we have a thickness of 140 ft. of conglomerate. The discovery was made on the contact of Keewatin and conglomerate.

I believe that this discovery will prove to be of distinct importance to the Peterson Lake Company. We are now sorting ore.

A QUICK-ACTING COUPLING FOR MINE SERVICE

The Cleveland Rock Drill Co. has placed on the market an improved coupling designed to overcome the waste of air in mines. The old style malleable iron union which has been in service for many years is not satisfactory. The claims made for the new coupling are that it never leaks, makes easy connection, is air-tight, cannot be accidentally disconnected, requires no wrench, has no threads, and has less parts than a union. All the couplings are interchangeable.

BOOK REVIEWS

METAL STATISTICS, 1914—Seventh Annual Edition —Issued by American Metal Market and Daily Iron and Steel Report.

This is an interesting summary of production and prices of metals during 1913. The statistics should prove useful to buyers and sellers of metals as well as plant managers and engineers.

MANUAL OF HYDRAULIC MINING—By T. F. Van Wagenen. Fourth edition, revised and enlarged—D. Van Nostrand Co., New York—Price $1.00 net.

This is a little book of 123 pages written for the miner rather than for the mining engineer. Its pages are devoted partly to methods of mining and partly to the elements of mathematics and physics. In this new edition there appears a chapter on dredging. The aim of the author is to provide a guide to the miner in preliminaries only, to be supplemented by advice from an engineer.

THE BASINS CF NELSON AND CHURCHILL RIVERS.

The Geological Survey has just published a report by Mr. Wm. McInnes on the country between Saskatchewan river and Hudson bay. It contains new information, geological and geographical, and presents also a summary of earlier publications. A map covering a rectangular area of about 220,000 square miles, having Fort Churchill at the northeast corner and Prince Albert at the southwest accompanies the report.

Mr. McInnes made several explorations in the area in 1906, 1907, 1908, 1909, and 1910. Other members of the Geological Survey whose work has been made use of in the descriptions and map making are Robert Bell, A. S. Cochrane, R. G. McConnell, J. B. Tyrrell, A. P. Low, and D. B. Dowling.

Concerning the resources of the region, Mr. McInnes says:

"The commercial possibilities of the region are great and varied. It contains, in the southern part, large areas of land suitable for settlement; its fisheries promise to be important, and, under proper restrictions, could be carried on commercially without the depletion of the waters. The timber, though confined principally to a belt on both sides of the Saskatchewan and its tributaries, is an important asset. Over the northern portion the trade in furs is of very considerable value.

"There is reason to hope that the region will be found to contain valuable minerals; it is traversed by several belts of Keewatin rocks (which probably include also areas of Huronian), and these, from our experience of like rocks elsewhere, may be looked upon as affording promising fields for the search for valuable minerals. Similar areas in central Canada have been found to contain many valuable deposits of ore, including ores of iron, nickel, silver and gold."

"The total amount of power capable of being developed from the many falls and rapids which occur on the rivers within the area, is almost incalculable. Some of the rivers are of great volume and all, along parts of their courses, have rapid descents.

"Of the rivers, the Nelson, by reason of its great volume and numerous falls, is the most important from the point of view of power development. Between Lake Winnipeg and Split lake, a distance of about 230 miles, the river has a descent of 240 feet, and between Split lake and the sea, 200 miles, a descent of 470 feet."

BRITANNIA MINES, B.C.

According to Mr. Wm. Fleet Robertson, Provincial Mineralogist of British Columbia, the extent to which the Britannia Mining and Smelting Company has enlarged its mining and concentrating operations, and the present and steadily increasing importance of the copper-mining industry this company has established on its property on and near Howe Sound, are not generally known. Between 600 and 700 men have been continuously employed for some time past, and the extensive development and construction works in hand, and to be undertaken as soon as can be done with advantage, assure the retention of fully that number at work for some time to come. Outlining briefly what is being done, it may be mentioned that, while the mines are being developed and ore extracted on a larger scale than in past years, the work of driving a 5,000-foot adit is also in progress, with 3,000 feet already driven and a daily advance of about 15 feet being made. As this tunnel is being driven on a level 1200 feet below the bottom of the lowest present mine-workings it will, if ore be found to continue down to that depth (which will give a total of fully 2,200 feet), make accessible for stoping an enormous quantity of ore. Mine equipment on a commensurate scale, hydro-electric development of 5,000 horse power, construction of railway from the mouth of the adit tunnel to Britannia Beach and other additional facilities for transportation, and the installation of a modern and effective system of ore-concentration, are included in the progressive programme adopted and being energetically carried out. It is understood that the "flotation process" of the Minerals Separation, Limited, for the recovery of copper minerals has been adopted here, and that a large treatment capacity is being arranged for, with the old concentrating-mill being altered to suit the new conditions and for use pending the erection and equipment of a new mill. The company mined about 193,000 tons of ore in 1912, as against rather more than 100,000 tons in 1911, and recovered between 14,000,000 and 15,000,000 lbs. of copper and between 70,000 and 80,000 ozs. of silver.

MICA.

Canada is one of the three principal mica-producing countries of the world, the others being India and the United States. The average value of the mica produced annually in Canada during the last ten years has been about $185,000.

With the exception perhaps of Ceylon, Canada is the only country, as far as is yet known, in which the variety phlogopite—or "amber mica," as it is termed in the trade—is known to occur in economic quantities. The mica of commerce is of two kinds—muscovite, or "white mica," and phlogopite, or "amber mica." The former is obtained from both India and the United States, while the latter is secured almost wholly from Canada. Of the two varieties, phlogopite commands rather the higher price, being softer and more flexible and altogether more suitable for use as an insulator—this being the principal use to which mica is put at the present day.

Mr. Hugh L. Cooper announces that he has completed the water power development of the Mississippi River Power Co at Keokuk, Iowa, and that he has opened offices at 101 Park avenue, New York City, where he will engage in the practice of general hydraulic engineering, including the design, construction and management of hydro-electric power plants.

GRANBY CO.'S METHODS OF MINING AND SMELTING AT PHOENIX AND GRAND FORKS

The main orebody at Phoenix has been opened up and mined at several levels. The upper three are tunnel levels, known as No. 1, No. 2, and No. 3, respectively, and have in turn been shipping levels. The lower levels, known as the 200-ft., 300-ft., etc., are served by a shaft known as the Victoria shaft.

The tunnels and the Victoria shaft have separate rock houses. During the past year 545,121 tons were taken from above No. 3 tunnel, and 505,623 tons from Victoria shaft.

A large portion of the deposit has been worked open cast. The underground openings are large and untimbered, the roof being supported by rock pillars. The main levels are at 100 ft. intervals. The method of developing and mining the ore body has been described* by Mr. C. M. Campbell as follows:

"In opening up a level parallel drifts, usually 75 ft. apart, are started in the direction of the strike of the deposit. At intervals of 45 ft. along the drift raises are begun. An 18 hole round is drilled and blasted. Before the muck is cleared away the bar is again set up and another round drilled and blasted. The third round is then drilled, but only the cut holes are blasted. All the rock is then shovelled up and the chute is built. The remaining holes of the last round are then blasted. As these throw the rock to the sides of the raise the timbers of the chute are uninjured. The raise is then carried ahead at an angle of about 45 degrees. This allows the ore to run and also enables the men to get about without the aid of timbering. For ventilation purposes the first raise of a series is usually carried through to the level above or some other convenient opening. In the case of the highest level the most convenient opening is the surface.

When the face of No. 2 raise is about 30 ft. above the sill-floor, stoping is commenced and it is widened out until it connects with No. 1 raise. The same thing is done at an elevation of about 60 ft. and breaking through to the next level at 100 ft. The only small work is the first 30 ft. In this way a network of pillars is left throughout the stope. So far a column only has been used. As soon as the sill floor above has been reached, tripods and long steel can be used to advantage. In this way a glory-hole is started and the opening can be widened out until the sides of the glory-hole get too flat for the ore to run. Machines are also put to work where the connections between the raises have been made and at other advantageous places. The stope may thus be turned back to meet the hanging wall and the pillars reduced in size. Where the nature of the ground permits, a pillar may be eliminated altogether.

"One series of raises is seldom sufficient to tap all the ore. If the foot-wall is flat a parallel drift in waste with accompanying raises will have to be driven. There will also be several drifts between the foot and the hanging walls. At one place on No. 3 tunnel level there are five parallel drifts now operating and at least another will be required. In this case the pillars in the stopes are left nearly vertical instead of at an angle as when the deposit is steeper. It is often advisable when breaking a raise through from a lower level to make the connection at the back of the chute timbers. The timbers can be taken out and a glory hole started. At the same time the raise can be carried ahead as a stope ten to fifteen ft. beneath the foot of the old stope. While stoping ahead, upper holes are drilled into the undercut rock. In this way the back is always within reach. In fact, it is rarely necessary to work in a stope at any great distance from the roof.

"When raising in waste no connections are made until the ore is reached. If the ore is at any considerable distance the raises are put in less frequently and are branched so as to tap the ore at two or three places. After the ore is blasted the large blocks that can be reached are bulldozed. No blockholding is attempted. It has been found cheaper to buy more powder than bother with hand or air-hammer drilling. When the raises are in ore there are always convenient temporar-

Granby glory-hole, Phoenix, B.C.

*Rossland Meeting, Canadian Mining Institute, May, 1908.

ily abandoned chutes which have been cleaned out, through which access is had to the broken ore in the raises. In the case of raises through waste where no connections have previously been made it is necessary to drive manways. To do this a staging is constructed midway between two chutes and about eight feet above the track, high enough to allow the trolley wire to pass under. The planks at the centre of the staging, over the cars, are movable. A miner with an air-hammer drill or a small ordinary drill starts a raise at about 60 degrees and continues for about 25 feet when he branches and drifts till he connects with the raises on each side. The waste with a little help is run into the cars without interfering with traffic."

Drifting.—"On the sill floors the haulage tunnels are always being driven ahead. On the levels where the big cars run these are about 9 ft. by 11 ft. in size. A twenty-hole round is used. This is made up of 4 lifters, 4 cuts, 8 breast holes in two rows, and 4 back holes. All the rock broken on the sill floor is hand-shovelled.

Handling the Ore.—"On the No. 3 tunnel level 10-ton, steel, hopper-bottom and 7-ton wooden, gable-bottom cars are operated. These run on a 3-ft. gauge track and are hauled by an electric locomotive. . . . A special steel car has been designed at the works. This car is 5 ft. high and can be used for sill-floor shovelling as well as for loading from the chute. The box has a 5-ton capacity and has an automatic side dumping arrangement. When a train comes to the unloading pocket, the motor goes ahead with slackened speed and a side wheel attached to the box runs up an inclined plane. The box tips, dumps its load and closes again. This arrangement has given excellent satisfaction."

"The Victoria shaft cuts the ore body where that deposit crosses the 400-ft. level. The shaft is on a 60-degree incline and connects with large storage pockets below the 400-ft.level. These pockets, ore and waste are connected by raises with the 300-ft level."

On the 400-ft. level the ore is hauled to the shaft in 5-ton steel cars by an electric locomotive.

Present Methods of Mining.—There has been no important change made in the terminals or haulage systems since Mr. Campbell's paper was published in 1908.

Mr. Campbell states that most of the changes since made in mining methods are minor ones, resulting from the fact that the ore bodies now being worked are in places flatter and not as regular as those formerly worked.

The method as formerly is to leave rock pillars to support the roof. These pillars are afterwards shot out and the ground allowed to cave. Where buildings are being undermined more ore is left in place and the stopes are filled with waste rock.

All the waste rock mined on the 200-ft. level has been used for stope filling, none of it having ever been hoisted. Most of the waste rock from the lower levels is hoisted and then dumped back into the mine and redistributed to fill the openings.

In 1910, the No. 3 tunnel terminals and some other mine buildings were destroyed. These were soon rebuilt, and, except for an increase in tonnage, the conditions are much the same as in 1908.

Victoria Shaft.—Mr. A. B. W. Hodges has described the Victoria shaft and equipment as follows:

"The shaft is 3-compartment, having a man-way 4 by 6 ft. in the clear, and two skipways each 5 x 6 ft. in the clear. The skips are balanced, hold about 5 tons of ore and run at a speed of about 900 ft. per minute. This will hoist 2,000 tons in two 8-hour shifts. The skips are hoisted by a double conical drum hoist driven by a 250 h.p. variable speed induction motor at 2,000 volts pressure. They generally run in balance; but can be operated separately in either direction.

"The sheave wheels of the gallows frame are about 90 ft. above the ground and are so elevated that the skip can dump about 60 ft. up and the ore run into either of two coarse ore bins, each holding 500 tons of ore."

Victoria Shaft, Granby Mines, Phoenix, B.C.

Crushing the Ore.—The crushers at the Victoria shaft and at the tunnels are very large Blake-type crushers having a jaw opening of 42 x 36 in. The breakers handle about 150 tons of ore per hour, crushing to about 7 or 8 inch. They are driven by 150 h.p. induction motors.

Transportation.—The crushed ore is loaded into 30 to 50-ton steel bottom dump railway ore cars. It requires about eighty 50-ton and eighty 40-ton ore cars, and five or six 150-ton steam locomotives to convey 3,000 tons per day to the smelter, which is located at a distance of

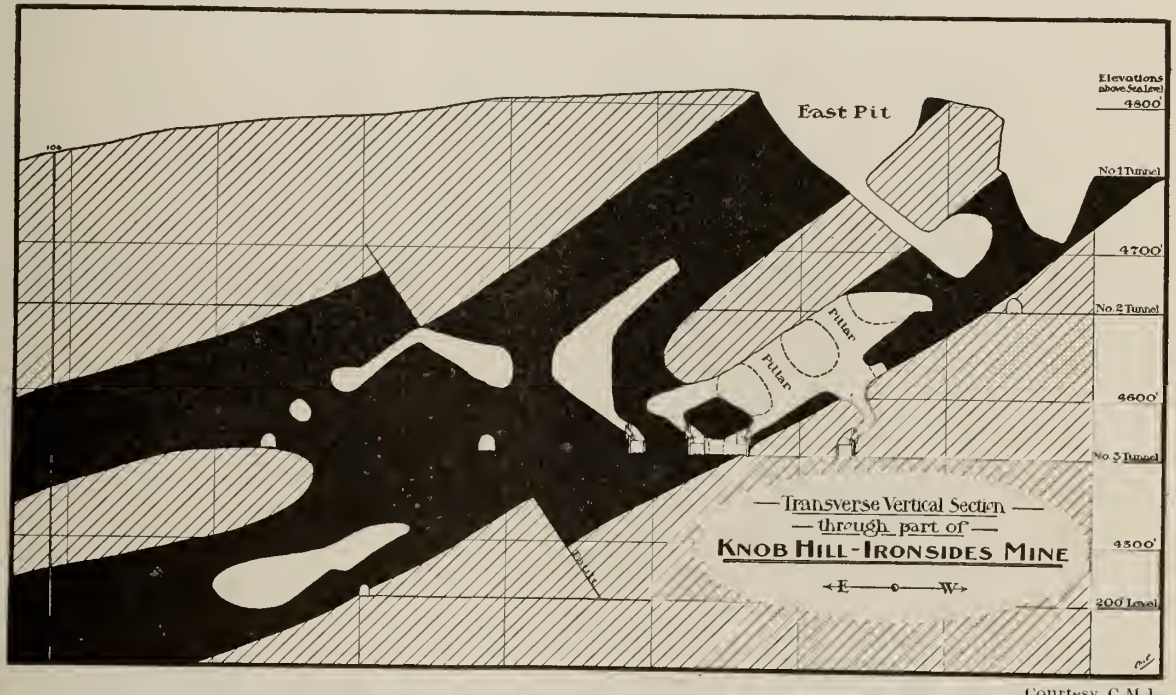
24 miles. The grade is about 3 per cent., making a stiff return pull with the empties.

"These ore trains are weighed at the smelter on track scales and are run out over the ore bunkers and the ore dropped into the different bins. Here there are three sets of ore bunkers parallel with one another and 750 ft. long, and each holds about 5,000 tons of ore.

"About one car in ten is set over the sampling bin and the ore from this is re-crushed and a sample automatically taken which fairly represents the day's shipments. The metal contents of the ore being so uniform very careful sampling is not required to determine its contents, in fact, one lot of 30,000 tons will not vary more than 20 cents per ton over or under another of similar quantity.

Charging the Furnaces.—"The ore chutes at the bottom of the bins are about 6 ft. above the furnace charging floor, so that the furnace charge cars are run under these spouts and receive the crushed ore by gravity, and these cars, which have already received the requisite quantity of coke in the bottom, are weighed again to get the proper amount of ore, and then the train of three cars is pushed on a 20-in. gauge track into the end of the blast furnace, when the charge is dumped into the proper place, these cars being just the length of the inside of the furnace. Each train of cars feeds two 44 x 210-in. blast furnaces and handles from 750 to 900 tons of ore per 24 hours.

"The track rails do not enter the furnace, but the cars are carried in on auxiliary wheels on the upper corners of the cars and run on tracks built in the sides of the furnace. These cars are divided longitudinally in the centre, and the doors open on each side, the hinge being at the top. This spreads the charge along each side of the furnace in the proper place. These charging cars are used only at the Granby smelter, and are an invention of the writer's. They are pushed around by a 30 h.p. electric locomotive, 250 volts direct current. Each train holds a little more than four tons of ore, together with the proper amount of fuel at the bottom of each car."



Courtesy C.M.J.

A vertical section showing the ore body at Knob Hill-Ironsides Mine, Phoenix
This sketch was made in 1908

Smelting the Ores.—Mr. Frank E. Lathe, in a paper presented at the 1910 meeting of the Canadian Mining Institute, describes the smelting plant as follows:

The Furnaces.—There are eight blast furnaces, housed in a steel building of 290 ft. by 71 ft., along the lower side of which is a shed 13 ft. wide. The old blower room is at one end and the converter department at the other, the second and newer blower room being near the converters. To facilitate the handling of ore, the bins parallel the furnace building. Recent enlargements have increased the length of furnaces from 213 in. to 266½ in., and the depth from 11 ft. 9½ in. to 15 ft. 8 in. The width at tuyeres remains the same, 44 in. The furnaces have two rows of jackets on each side and end, these reaching practically to the feed-floor. Above them is brickwork, ordinary red brick being used for the outside and firebrick for those parts exposed to the greater heat. The whole brickwork is strongly bound with 56 lb. rails, while I-beams, in addition to the buckstays mentioned above, keep the jackets in position. Two outlets are provided for the gases, one leading to the dust chamber and the other, for use in emergencies, opening into the air. Both are provided with dampers. The jackets are of riveted steel, 7-16 in. and ⅜ in. thick on fire and air sheets, respectively. The water space on upper jackets is 3 5-16 in., on lower ones 4⅞ in. All have deflectors to throw cold water to the bottom, and hot water is taken from the extreme top. The lower jackets are 7 ft. 6 in. high, and the upper 7 ft. 9 in. There is a good circulation of water, cold water entering the upper jackets and flowing thence to the lower set. This tends to keep a cool top, and prevents undue chilling at the tuyeres, which might attend an opposite circulation. For this purpose 2,000 gallons of water per minute are required by the eight furnaces or the equivalent of three gallons of water per minute per square foot of hearth area. Water enters at a temperature of from 35 to 50 degrees F., and issues at an average of 140 degrees F. The blast varies from 24 to 28 ounces, and each furnace takes about 25,000 cu. ft. of air per minute. There is a con-

stant flow of matte and slag from each furnace into its settler through a water-cooled spout. The trap is 5 in. to 5¼ in.

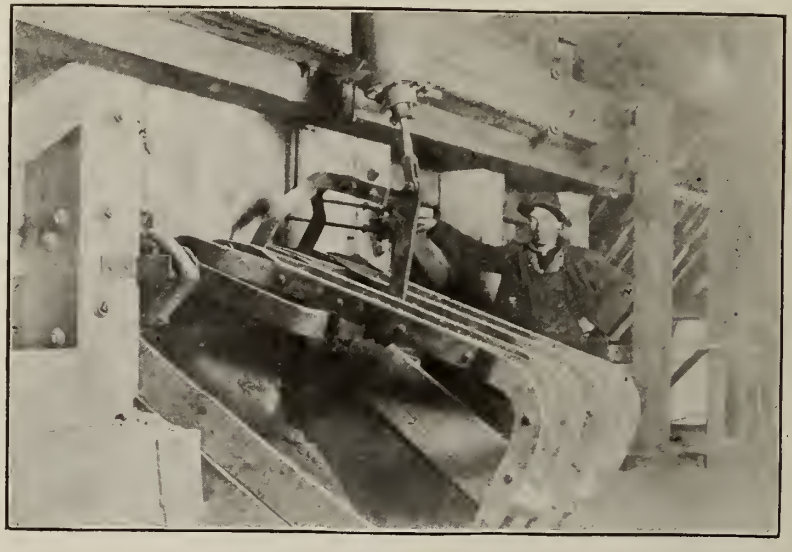
As the ore is low in both copper and sulphur a high ratio of concentration is possible, this being usually about 32: 1. Moreover, a recovery of 85 per cent. of all values is regularly attained. This high percentage is all the more noteworthy when the grade of the ore is considered. The coke consumed is about 12½ per cent., with few extras under ordinary conditions.

An average analysis of all Granby ores is about as follows:

SiO_2, 35 per cent.; Fe, 13 per cent.; CaO, 17 per cent.; Al_2O_3, 8 per cent.; MgO, 3 per cent. Copper varies from 1.2 per cent. to 1.6 per cent. The "insoluble" in the ore is considerably higher than the silica given above, the latter being determined by fusion. The iron is present as silicates, uncombined oxides and sulphides, while nearly all the lime and magnesia exist as carbonates. Chalcopyrite is the only copper-bearing mineral, and it also carries gold and silver. Of the sulphur about 65 per cent. is burnt off, producing a matte of 35 per cent. to 40 per cent. copper.

of 500 to 600 tons per furnace. A maximum of about 750 tons has been reached, equal to nine and a quarter tons of ore per sq. ft. of tuyere area. This is in addition to converter slag and briquettes, though the amount of these is comparatively small. As the work of alteration was but recently completed no figures are yet available for tonnage on 8 enlarged furnaces, but 7 have smelted 4,200 tons in 24 hours. An average of 4,000 tons per day has been maintained for some time with 7 furnaces, and with 8 in operation it may reasonably be expected that this figure will be raised to 4,500 tons, with a maximum of not less than 5,000.

Briquetting.—"The greater part of the dust from the furnaces is collected in the new steel flue chamber paralleling the furnace building. This chamber is at a height of about 21 ft. above the feed-floor level, and consists of a rectangular flue 15 by 13 ft., of 3/16 and 5/16 steel plate. A partition across the chamber, as shown, prevents an undue quantity of gas from going to either stack. The bottom is made up of hoppers, which discharge through 9-in. openings into a trough kept clean by a wire rope drag conveyor. The attendance of one man is required for a short time each day



Courtesy C.M.I.

Granby air operated ore bin gate

Slag.—With the above ore charge the slag will have the following composition:

SiO_2, 44.8 per cent.; FeO, 19.3 per cent.; CaO, 21.8 per cent.; Al_2O_3, 10.2 per cent.; MgO, 3.9 per cent. In the actual operation, owing to the return of converter slag, the silica is slightly lower and the iron oxide a trifle higher than these figures. In this slag the ratio of oxygen in the silica to the sum of that in the iron oxide, lime and magnesia is 1.87: 1. From the above analyses it will be observed that the ore is easily self-fluxing, and while not quite ideal in composition, the addition of barren fluxes would be attended with loss rather than profit. Owing to the small percentage of iron in the slag the specific gravity is low—about 3.0. Hence a good separation of matte and slag is obtained. The percentage of copper passing into the slag varies from 0.20 per cent. to 0.25 per cent., though some furnaces, operating under ideal conditions, have attained, during a month's operation, even better than this lower figure.

Furnace Output.—"As mentioned above, ore is charged every 20 to 30 minutes, giving a daily capacity

to control the flow of dust from the hoppers, all other movements being automatic. The brick chambers at either end of the steel chamber collect a comparatively small quantity of dust, this being drawn by hand out of openings in the side and conveyed in barrows to the briquetting mill. Here all flue dust is dumped into a receiving bin from which it is drawn by an automatic feeder to a mixer. After being moistened it is mixed thoroughly, no binder being necessary, and then goes to a No. 2 White briquetting machine with a capacity of 4,000 briquettes per hour. This ejects the newly made briquettes on a belt conveyor, which transfers them to furnace charge-cars. They are returned to the furnace without drying. The output of the briquetting mill is about 24 tons per day.

Settlers.—"Two settlers are used for each furnace. The one next the furnace, and which receives the matte and slag as they flow out continuously, is rectangular in shape, 7 ft. by 5 ft. with corners rounded, and 3 ft. high. It is surrounded by a 2-in. continuous water-jacket, the inner plate being ⅜ and the outer ¼ in. steel. The bed-plate is of cast iron, 2 in. thick, and

removable. Before being used the settler receives a course of fire-brick on the bottom, and is then lined on both bottom and sides with quartz cemented with clay, as for the converters. The life of a settler is usually determined by the rate at which it fills with metallics. When the bottom becomes so high as to materially decrease the capacity of the settler, the latter is replaced by a newly lined settler, while the metallics are removed from the former and broken up with a heavy ball weight. The separation of matte and slag is nearly complete in the settler just described; but a small amount of matte is obtained in the second settler to which the overflow from the first passes. This is smaller, about 4½ by 5 ft., but of the same general construction. Once a day it is tapped into a small pit, and the product thus obtained is broken up and returned to the furnaces. The large settler is tapped as often as may be necessary, the height of matte being found by introducing vertically a small iron rod, to which only the slag adheres. From the second settler the slag passes into slag cars standing on tracks of 36-in. gauge which run on either side and are used alternately. The capacity of these cars or pots is 5 tons each, and they are so balanced that when full they are in unstable equilibrium. Small steam locomotives convey them in trains of 4 to 6 cars to the edge of the dump. Here a chain is first thrown around the car frame and under the track on which the car is standing, to prevent the car from tipping over when the slag is dumped. The pot is then released from its upright position and turns on its side, the molten slag pouring out. Being empty the pot is now easily brought back to its original position, so that when the chain is removed it is ready to return to the furnace for another load. Before being refilled each pot receives a wash of clay water, to prevent the solidified shells of slag from adhering to it when dumped. Four locomotives handle all the slag from the 8 furnaces, while 30 to 40 pots are usually in commission at one time.

"Two 10-ton electric cranes run the whole length of the furnace building, handle matte, change settlers, remove furnace spouts, etc. One is usually kept in reserve. The matte is taken in 5-ton pots into the converter building, where it is received by the 40-ton crane operating there and poured into the converters.

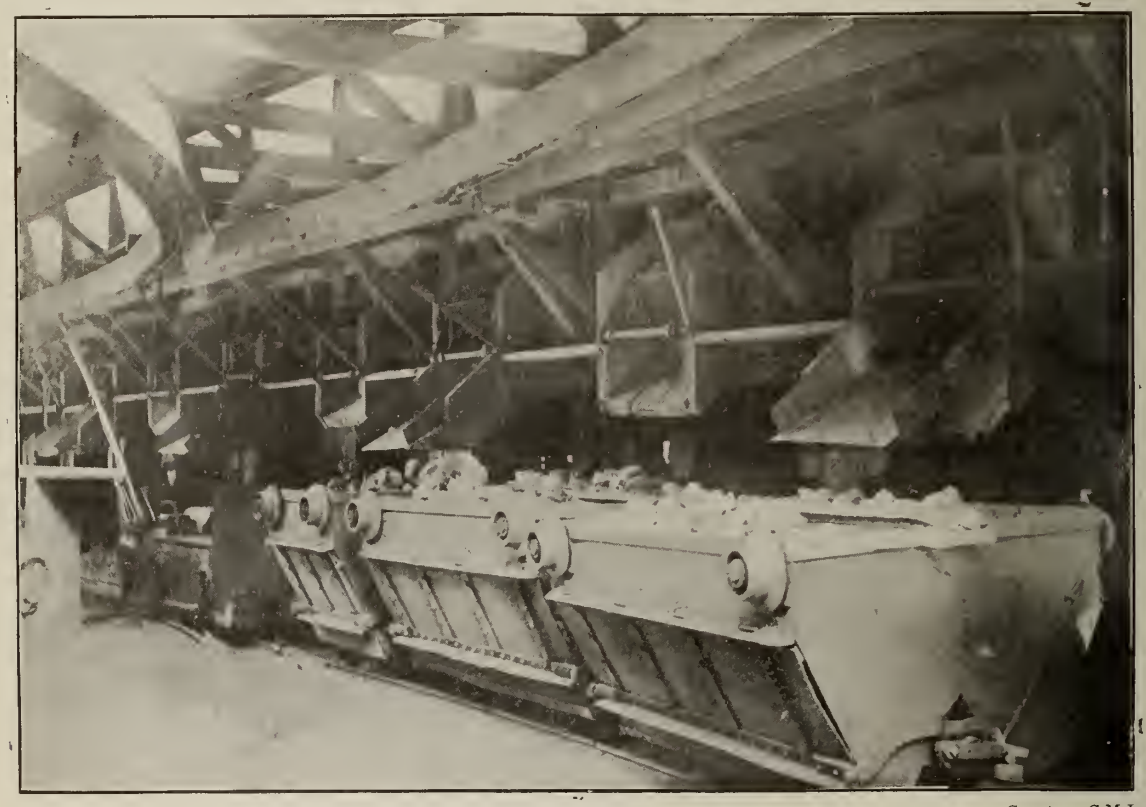
"**The converter department** is housed in a new steel building 100 by 240 ft. The equipment consists of 10 converter shells, 84 in. by 126 in., recently purchased from the Power and Mining Machinery Co., 3 shells 72 by 100, 3 stands for the large and one for the small converters, moulds for metallic copper, with their trucks, a slag-casting machine with conveyor, and, in the relining department, clay stalls, quartz bins, and 3 mud mills. The old converters were operated by hydraulic power, while the new ones are equipped with 25 h.p., 220 volt, D.C. motors. All are lined next the shell with chrome brick, some magnesite brick being used around the tuyeres, to protect the metal with a layer of material that will not be readily attacked by matte or slag. Inside this is placed a 2-ft. layer of silicious ore, cemented with clay, and well tamped. Silica brick is used on the caps. The ores are of several classes, all high in silica and low in sulphur and bases, but containing their values as gold, silver, copper or any combination of them. The Granby Company has no highly silicious ores on its own properties; but has no difficulty in obtaining enough such custom ores, so that no barren quartz is used. There is no definite quantity of matte per charge, as the converters are seldom run to the limit of their capacity. Besides obviating the necessity of a receiving furnace for matte this also enables a transfer of charge to be made from one converter to another, when the occasion arises.

Courtesy C.M.I.

A Granby Ore Train

Converter Output.—"The yearly capacity is fully 40,000,000 pounds of copper. A blast of about 12 pounds per sq. in. is used, and the copper produced is 98.50 to 99.00 per cent. pure. The trucks which carry moulds for the metallic copper are 16 ft. long, and run on 44-inch. gauge tracks. Each carries 8 moulds 33 in. by 24 in., outside dimensions, forming a continuous row from car to car. A train of these cars is drawn by a wire rope underneath the converter to be poured. When the last mould is directly under the mouth of the converter it is turned over and the copper is then poured out in a continuous stream, the train being pulled forward as the moulds are filled. Each bar of copper as thus cast weighs about 220 lb., and after being removed from the mould and trimmed it is weighed and placed in a car for shipment.

Converter Slag.—"The pot into which slag has been poured is picked up by the crane and placed in a frame which is gradually tilted by hydraulic power. The slag pours out into the moulds of a conveyor that carries it up an inclined plane, under sprays of water, into a bin from which it is drawn to steel railroad cars. A 5 h.p. motor is sufficient to drive the conveyor, which moves at a speed of about 12 ft. per minute. About 100 tons of converter slag are produced in 24 hours. This contains up to 40 per cent. of silica, and varying amounts of copper, the remainder being principally iron oxide. It is returned to the bins and thus to the blast furnaces.



Courtesy C.M.I.

A Granby Furnace-charging Train at Ore Bunkers, Grand Forks

Power.—"The blower building recently rebuilt of brick and steel, houses three No. 7 and four No. 8 Connellsville blowers, the capacities of which are 12,000 to 14,000 cubic feet per minute each; and one No. 10 capable of delivering 30,000 cubic feet per minute. The small blowers are each driven by a 100 h.p. Westinghouse induction motor, 400 volts, 3 phase, 60 cycle, which, however, carries some overload. The large blower is driven by two 150 h.p. motors of the same type. In the newer building, which is also of brick and steel, and has lately been enlarged, are four blowers similar to the large one in the other building, and the three blowing engines supplying air to the converters. These are Nordberg 36 by 36 and Allis-Chalmers duplex 34 and 34 by 36, of 3,700 and 6,000 cubic feet per minute capacity, respectively, both belt driven, and a Nordberg 40 and 40 by 42, with rope drive, furnishing 10,000 cubic feet per minute. Power is supplied to these engines by motors of 200, 300 and 500 h.p., in the order named. In this building are also a small compressor, supplying air at 80 lb. pressure for tamping the converters, riveting, etc., a 200 h.p. motor generator set, and a pump furnishing water for hydraulic purposes at 200 lb. per square inch pressure. This pump supplements a gravity hydraulic system which supplies water at 160 lb. pressure. The Granby power house, situated immediately below the smelter on the river bank, receives water under 40 to 50 feet head from a flume coming down the bank of the river from a dam about three-quarters of a mile above the smelter. Power is furnished for the pumps, of which there are five, each capable of delivering 500 gallons per minute, against 200 feet head. Of these, two are connected to water-wheels, the other three being driven by motors. Direct current is also supplied at 110 volts for the office and laboratory, and for lighting, and alternating current at 440 volts for use on the works, in all about 900 h.p. In addition to this about 1,200 h.p. is received from the West Kootenay Power and Light Co., and now transmitted at 60,000 volts from Bonnington Falls. This is transformed to 440 volts and then distributed to the smelter. The motor generator set in the blowing en-

Settlers, Granby Smelter. Grand Forks, B.C.

gine room supplies the cranes and electric locomotives with direct current at 250 volts.

Results of Furnace enlargements.—"The enlargement of the furnaces has brought about many changes. It has been conclusively proved in practice that, other things being equal, the tonnage smelted per square foot of tuyere area will be greater for long than for short furnaces. This is true for several reasons. As the end surfaces are the same, any enlargements having affected the sides only, the cooling surface has not increased proportionately to the area. The same applies to incrustation. Moreover, as the percentage of end surface has decreased, so also has the formation of accretions, these having much less opportunity to adhere firmly to the long sides than to the ends and corners. There being a greater flow of matte and slag from the furnace these will be hotter, and more fluid. The ratio of cooling surface to tuyere area having been reduced so will the amount of jacket water per ton decrease, and with it the loss of heat, thus making a saving of coke. It will usually be found also that the labor required does not increase proportionately to the output. All these points are true for the lengthening of furnaces without deepening, and the Washoe Smelter at Anaconda, Mont., may be given as the most conspicuous example of success attending such enlargements. There are, however, still further and no less important advantages to be derived from the deepening of furnaces, in some instances at least, and these will now be considered in the case of the Granby Smelter.

"Other things being equal, the deeper the column of ore in a furnace the less sulphur will be burnt off, the result being a lower grade of matte, and as this requires more iron to unite with the sulphur the slag will be somewhat more silicious. With the deepening of the Granby furnaces the copper in the matte was decreased by from 5 to 10 per cent. and the iron in the slag about 1 per cent. This meant more matte to handle, additional work for the converters, and more converter slag to be returned to the furnaces, as well as a more difficult fusible blast furnace slag. Here, however, the disadvantages end.

"When the matte is low grade more silicious custom ore will be used for converter lining, and, although this only partly offsets the additional expense, yet the cost of converting, compared with that of the initial smelting, is small per ton of ore treated. Moreover, the converter slag is useful in the furnaces, and often assists materially in righting a furnace that is working badly. It is worthy of notice that however much iron is taken from the blast furnace slag to form a low grade matte all is finally returned to the furnace, the only disadvantage being that some additional silica is returned with it.

"The smaller the amount of sulphur burnt off in furnace the less chance there is of the formation of metallics. This has been a marked improvement on the deepening of the Granby furnaces, especially in the case of the two with the smaller tuyeres.

"The present blast furnace slags are more silicious than formerly, as already noticed; but the operation of the furnaces is so much more even that there is less difficulty under present conditions. A good tonnage has been maintained with 47 per cent. silica slags over a period of several weeks, while before deepening there would have been difficulty in preventing the furnace with this slag from freezing. The tonnage attained per square foot of tuyere area is about 10 per cent. greater than formerly.

"In the old furnaces, with a lower column of ore, much of the heat necessarily extended to the top of the charge, so that the gases on leaving were highly heated. This not only caused a needless loss of sensible heat in the gases, but the high temperature to which the downtakes and the steel flue chamber were subjected necessitated more frequent repairs. By a deepening of the furnace this hot gas has to pass up through a body of cooler ore, to which it imparts a considerable portion of its heat, thus saving from two to three per cent. of coke and the damage done to the metal with which it comes in contact is much less.

"The labor required at the smelter to handle the larger output is practically the same as before, so that a considerable gain is made here.

Charging a Converter, Granby Smelter, Grand Forks, B.C.

"The greatest saving of all, however, is found in the amount of copper that passes into the slag. The lower grade of matte, greater matte flow, hotter matte and slag, and even running of the furnaces all tend to a more perfect separation of matte and slag, and the danger of the formation of copper oxide is decreased. The percentage of copper in the slag has thus been lowered 0.05 per cent. While this quantity may not seem great at first sight, it amounts in the course of a year to $150,0000 or $200,000."

THE INTERNATIONAL GEOLOGICAL CONGRESS*

By H. Mortimer-Lamb.

The meeting of the International Geological Congress in Canada in 1913 was of exceptional interest and magnitude; and its success was a performance in the highest degree creditable to all those concerned in making it so. Probably no international organization has had lavished on it in the past more attention, respect and hospitality than the International Geological Congress. The meetings in Russia, Mexico, and Sweden, to mention but three, were remarkable instances of successful organization. But, although in these respects the difficulties and disabilities in Canada were incomparably greater, it is conceded generally that the meeting in this country was the most memorable of all. In Russia only were the problems associated with arrangements for long distance traveling as knotty as those solved by Canadians; but the railways in Russia are owned and operated by the State, and the official service was at the disposal of the geologists. Here it was obligatory to carry on negotiations with a dozen different transportation companies, and but for their hearty goodwill and co-operation, the undertaking would have been impossible. In Mexico, the necessary funds, amounting to an enormous sum, were provided by the government. In Canada, the Federal and Provincial administrations were asked to contribute but moderately, the balance of the money being made up by private contributions. The attendance, moreover, in Canada was the greatest on record—a thousand, it is said, registered in Toronto and five hundred or more participated in the different excursions. Of these excursions there were twenty-eight, representing probably in the aggregate from forty to fifty thousand miles of travel. The figures are stupendous. But the most distinguishing and outstanding feature of the Congress was the disinterested, unselfish and wholesouled devotion and zeal of those who were directly responsible for its success. Many will not even get recognition; few will either expect or desire it. Theirs was that service which is the expression and manifestation of true communal feeling and high sentiment. The best work is not done for reward. Some have mentioned the practical advantages of meetings such as these. If they served no other purpose than to bring out these better sides of human nature, their occasion would be amply justified. We are so concerned with materialities that we are apt to overlook the fact that the development of the higher qualities of the race is more important than the exploitaion of natural resources. Yet the Geological Congress has its practical, its utilitarian side, too. There never was a time when the strictly scientific study of geology was so subordinated to economic enquiry and ends. The art of mining to-day owes an immense debt to the science of geology, and that debt continues to accumulate in increasing ratio. The intercourse, the interchange of views at such meetings as these, between men of the highest eminence, must necessarily advance knowledge and facilitate the solution of problems having in many cases a direct and important connection with economic considerations.

Visual impressions are more indelible than impressions obtained from descriptions, and it may be safely assumed that having seen conditions as they exist in Canada, our geological and mining literature will be read hereafter by those who visited the country last summer not only with greater avidity, but with greater grasp and interest. In consequence, geologists in every country will become better familiarized with Canadian mineral resources, potentialities and phenomena, and from these sources accurate information will presently filter into commercial circles. A further accomplishment by the last Congress, in the highest degree of practical utility, was the publication of a monograph on the subject of the coal resources of the world. The contributors are all recognized authorities. The work itself was edited, printed and published by Canadians.

I have referred to the disinterested zeal of those Canadian geologists and mining men on whose co-operation the success of the meeting was mainly dependent. But just as after the battle, it is the victorious general on whom the glory reflects, although the prowess of his army is fully recognized, so now, without invidiousness, no name may be mentioned excepting that of the Worker-in-Chief. The choice of Dr. Frank D. Ddams for the Presidency of the Congress was a singularly appropriate one. It was a recognition in the first place of his scientific standing and attainments; but it was still more a recognition of his abilities as an organizer and leader. That in the person of one individual there should be developed to an equal degree of perfection both the scientific and business faculties, is not believed by most laymen to be possible. Dr. Adams has (and there may be others) clearly demonstrated that a really good geologist, so good as to have a big international reputation, can be also an exceedingly capable man of affairs. He directed the organization arrangements with tireless energy, patience and tact. No detail was too small for his personal attention. As presiding officer, host, and chief representative of Canadian geology, he worthily upheld the dignity of his profession, his office and his country. When the general is honored, the army is honored, and the Government of Canada could take no action that would be better appreciated by the mining men of the Dominion than by recommending to His Majesty, the King, that some special distinction be offered to Dr. Adams in acknowledgment of this and the many other great public services, both to education and science, by which his career has been marked and distinguished.

*From McGill University Bulletin, December, 1911.

VANCOUVER CHAMBER OF MINES.

In our last issue we published a paper on the treatment of zinc ores, with special reference to those of British Columbia. This paper was prepared by Mr. A. J. C. Nettell for presentation at the January 19 meeting of the Vancouver Chamber of Mines. This organization, composed of business and professional men interested in mining, is endeavoring to promote the industry in British Columbia. A number of interesting papers have been read at meetings during the winter.

HOLLINGER GOLD MINES, ANNUAL REPORT, 1913

The report of the Hollinger Gold Mines, Limited, for the year ending December 31, 1913, has been issued. President N. A. Timmins says, in part:

In spite of the great handicap imposed by the very serious labor disturbance which existed during its early months, the year has been a prosperous one, and the developments in the mine have in all cases come up to expectations. From the treatment of 138,291 tons of ore, a profit of $1,628,113.64 has been made. The total profit is not all represented by cash, for there has been re-invested in plant $105,751.56 and in development $10,100.97, besides an expenditure of $3,600.00 for the purchase of lots in the town of Timmins. The amount brought forward as "Surplus" at the beginning of 1913 was $351,801.69, and during the year, after paying out $1,170,000.00 in the form of dividends, there was added to Surplus Account the sum of $458,113.64, which brought the account up to $809,915.33. Following a policy of reducing to a minimum those assets which are not convertible, there has been written off from "Plant" the sum of $105,751.56, from "Development" the sum of $15,100.97, and from "Real Estate" the sum of $600.00, thereby reducing the surplus which has been carried forward to the new year to $688,462.80.

Hollinger Mine Buildings and Mill, Timmins, Ont.

It will be readily seen that this latter amount approximates a cash surplus owing to the ease with which the "gold" items may be converted into cash. From a mining standpoint, our position is much stronger than the Balance Sheet would show, owing to the large sums which have been expended upon development work, but which sums have been absorbed in costs of operation. It is usual to carry these development costs as a deferred charge, to be apportioned at a fixed rate per ton to all ore made available by the development work, and in order to place our costs upon a basis for fair comparison with the costs of mining companies in other parts of the world, we shall in future adopt the policy of carrying the costs of development in a "Deferred Charges" account. It will be noted that during the past year there has been added to Capital Expenditures the sum of $10,100.97 on account of development. This item represents the expenditures made in connection with the sinking of shafts Nos. 4 and 5, located respectively upon veins Nos. 7 and 44. These two shafts are entirely new work, carried on at considerable distances from the main workings, and represent in reality two new operations, distinct from the producing mine, and therefore rightly chargeable to capital expense.

Ore Reserves.—The matter of ore reserves is all important, and it is felt that shareholders will not be disappointed over the results of development as set forth in the Manager's Report. After removing $2,566,666.24 from the mine during the year, an increase in the ore reserves is recorded, which means that approximately $3,000,000.00 of new ore has been opened up. Considering the small progress made upon development work during the first half of the year, while during this same period heavy inroads were being made into the ore previously blocked out, it must be admitted that the mine has shown remarkable recuperative power, in not only recovering from this heavy drain upon its resources, but actually at the year's end having more ore in sight than at the commencement of the year. In connection with the estimated ore reserves, the fact that we now have a surplus account which shows $510,462.80 in cash and quickly convertible assets, must not be lost sight of, nor must we forget that besides an increase in the estimate of ore reserves, there was, before writing down, an addition of $458,113.64 made to the surplus; that is to say, besides taking from the mine the amount of our dividend requirements, we also converted over $450,000.00 of our last year's estimated ore reserves into a definite "surplus."

Probable Ore.—While it is not permissible for an engineer to include "speculative" ore in his estimates of ore reserves, yet it is permissible and desirable that the speculative features shall not be passed by without comment. You will find in the Manager's Report that he draws attention to the probable results if the main ore bodies extend throughout to the depth of our deepest workings. This is a very reasonable assumption, and the matter is brought to the attention of shareholders in order that they may have some conception of future possibilities. There are no local data upon which to base a definite estimate of possible depth for the persistence of ore bodies—we are all quite in the dark in regard to this important matter—but so far as we have gone there has been nothing to indicate to our engineers that the veins are not likely to persist to considerable depths below present workings. All information possible is placed before shareholders in order that they may form their own conclusions and estimate for themselves the possibilities.

Milling.—The results of milling are very satisfactory, and while there is, of course, a steady improvement in metallurgical practice throughout the world, it will be found that the Hollinger practice is modern in every respect, and our engineers are constantly striving to

keep their practice thoroughly up to date, being careful meanwhile to avoid costly mistakes. After eighteen months of operation it can be said that the mill is entirely satisfactory and the correctness of the process adopted has been amply proven.

Labor, Etc.—Your directors are pleased to be able to report that the very serious labor trouble which was in progress during the early part of the past year has entirely subsided. It was an ill-advised movement, and the responsible parties were only successful in imposing a great deal of hardship and suffering upon the workmen and their families. During the year $46.832 was expended upon bunk houses and dwellings. This is in keeping with our policy to house our men comfortably. We now have ten 5-room cottages, three 7-room cottages and seven 2-family cottages with four rooms to a family, in all, accommodation for twenty-seven of our married men and their families. This is in addition to quarters which have been provided for heads of departments and their families. Our new bunk houses consist of plastered rooms, two single beds in a room, steam heat, electric light and modern sanitary arrangements. Various other departures which will be of benefit to the men are under consideration, and it is our intention to continue a policy of fair treatment to employees. This year we are inaugurating a system of rewards for loyal services, whereby employees will participate more fully than before in the earnings of the company.

The faithful and very efficient service of the general manager calls for words of especial appreciation, nor can we omit a reference to his very capable assistant, Mr. A. R. Globe, and the other members of the staff, without whose hearty interest and co-operation the favorable report submitted could not have been possible.

975.10, a rate of depreciation far exceeding the requirements of ordinary wear and tear. Development charges amounting to $175,000.00 are carried forward in capital account, a sum which distributed over the indicated tonnage in ore reserves, amounts to but slightly over twenty cents per ton, and while further development of the ore bodies is necessary before the entire 845,300 tons may be removed, the cost per ton will nevertheless be small.

Directly and indirectly, the labor troubles experienced during the first months of the year cost us approximately $120,000.00, as indicated by the high operating costs shown for the period of unrest. During the last three or four months we have been gradually getting back to normal working conditions and our costs of operating have benefited thereby.

Expenditures for plant and equipment have amounted to $105,751.56.

Approximately twenty-seven per cent. of the ore hoisted from the mine came from development. Considering the small amount of development work accomplished during the first six periods of the year, owing to the unsettled labor conditions, this showing is most satisfactory.

There has been a gradual improvement in the efficiency of the workers, beginning with an output of approximately one-half a ton per man per day in January, and ending with something over one ton per man per day during the last three months of the year. Concurrently with the increase in tonnage produced, a steady and decided improvement has been made in the amount of development work done. The efficiency of the men is higher at the present time than it was previous to the strike, and it is evident that the strike had a beneficial effect in bringing a better class of men into the district, and thereby raising the standard of workmanship.

Estimated Ore Reserves, Hollinger Mine, January 1, 1914.

	Tons.	Value per ton.	Estimated Gross Value.	Estimated at beginning of 1913.
No. 1 Vein	284,200	$19.56	$5,559,900.00	$6,026,100.00
No. 2 Vein	208,400	10.22	2,129,500.00	2,648,250.00
No. 3 Vein	22,600	7.47	169,000.00	169,000.00
No. 4 Vein	121,100	11.55	1,398,800.00	1,012,000.00
No. 5 Vein	35,200	11.55	406,500.00	.....
No. 7 Vein	25,200	10.51	265,000.00	.....
No. 8 Vein	35,900	9.11	326,000.00	77,150.00
No. 37 Vein	32,800	12.22	400,900.00	400,900.00
No. 38 Vein	8,100	15.31	124,000.00	124,000.00
No. 41 Vein	2,200	15.09	33,200.00	33,200.00
No. 44 Vein	9,600	20.00	192,000.00	.....
Veins 9, 11, 12, 13, 14, 23, 33, 35, 36, 39, 42, and 43.	60,000	10.00	600,000.00	730,000.00
	845,300	$13.71	$11,604,800.00	$11,271,400.00

The Manager's Report.

General Manager P. A. Robbins says, in part:

Earnings in 1913 amounted to $2,471,273.19. Of this $843,159.55 has been charged to operations, $1,170,000 paid in dividends, and $458,113.64 added to surplus. The surplus carried forward shows a healthy condition, being made up of approximately $510,000.00 of cash and quickly convertible assets, and only $178,000.00 of capital assets. The position of the company is stronger than the Balance Sheet indicates, owing to the large sums which have been spent upon development work, and which sums have been absorbed in costs of operations. From plant costing $711,975.10, there has been written off in two years, the sum of $211,

The average value of the reserves in No. 1 Vein are this year estimated at $19.56 per ton, while last year they were estimated at $28.86 per ton. This falling off in value is largely due to the fact that during the early part of the year we were engaged in a serious labor dispute, and in order to keep up the output of gold, it was necessary to draw ore from the richer parts of the mine, to compensate for the small tonnage being treated. In consequence of this the ore in No. 1 Vein above the 100 and 200-ft. levels was robbed of some of the richer portions, and the balance of ore now left above those two levels naturally shows a smaller value than was the average value before the richer portions were removed. There has also been some falling off

in the average value of the ore upon the 300 and 425-ft. levels, as compared with the values encountered upon the surface and 100 ft. levels, but by way of compensation for this, the average width of the ore upon the lower levels is greater than upon the upper levels.

No. 2 Vein shows a decrease in the estimated value of the reserves. This is primarily due to more conservative estimating. Last year the estimates for this vein were largely based upon the results of bore holes and crosscuts, while in the present case the estimates are based upon the more extensive development work which has been accomplished during the past year.

No. 3 Vein is included at the same figures that were given last year, as practically no new development work has been done upon this vein during the past year. An important point which has not affected the estimate, but which may be noted, is the result of diamond drilling for No. 3 Vein upon the 200 ft. level immediately below the drift upon the 100 ft. level. A drill hole passed through 10 ft. of ore showing high values, but owing to the known characteristic of this vein to carry high values in spots, the results of the drilling test have been disregarded and no allowance made for the ore indicated.

No. 4 Vein shows an increased reserve, although considerable ore from this vein has been milled during the year.

Nos. 5 and 7 were last year included under miscellaneous veins, and the estimated values of the reserve are based upon development work.

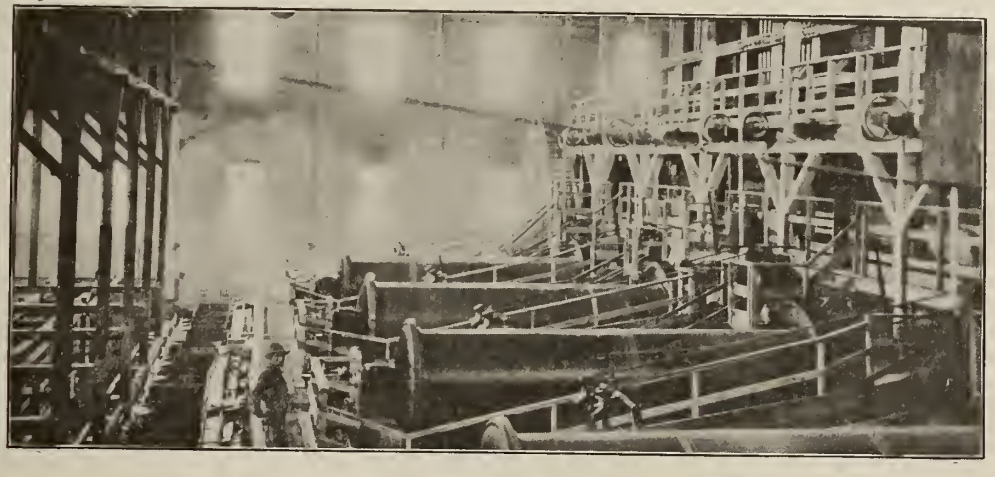
Veins 37, 38 and 41 are included at the figures estimated at the beginning of 1913.

In the last annual report Veins 5, 7, 9, 11, 12, 13, 14, 23, 33, 35, 36, 39, 42 and 43 were grouped as "miscellaneous," and were included in the estimate of ore reserves for an aggregate of 70,000 tons containing $730,000. During the year 1913, No. 5 Vein has been partly developed upon the 100 and 200 ft. levels, and shows a reserve of 35,200 tons estimated to carry $406,500.

A shaft has been sunk upon No. 7 Vein to a depth of 123 ft. and the vein at that level is found to be unchanged, so that No. 7 Vein is estimated to contain 25,200 tons carrying $265,000.

No. 44 Vein, not previously included in estimates, is another of the miscellaneous veins and sufficient work has been done upon this ore body to justify an estimate of 9,600 tons carrying $192,000 as proven ore. The work done upon these three veins shows the conservatism of the previous estimates, and the inclusion of Veins 9, 11, 12, 13, 14, 23, 33, 35, 36, 39, 42 and 43 in the present estimate of ore reserves, for a tonnage of 60,000 and a gross value of $600,000, is merely a nominal rating. No work has been done upon these twelve veins other than the sampling of their outcrops. Recently, by means of a diamond drill hole driven horizontally from the workings upon the 425 ft. level, we have found two ore bodies, located to the east of No. 1 Vein in unprospected territory. No allowance has been made for the possibilities of these discoveries.

The estimates at the commencement of 1913 showed 644,540 tons, valued at $11,271,400.00. During the year there have been removed from the mine 138,291 tons, containing $2,566,414.59 gross value. The present estimate shows 845,300 tons, containing $11,604,800.00, which incidates the development during the year of 339,051 tons of ore, containing $2,899,814.59. The average grade of all ore in reserve shown at the beginning of the year was $17.48 per ton, while that shown by the present estimate is $13.71 per ton. This falling off in average value is due principally to the fact that by far the greater part of the year's development work has been done upon veins of comparatively low values, thus bringing about a lowering of the over-all average in the mine. The policy followed in development has been to open up all ore of a profitable grade, rather than to confine development to the higher grade ore bodies. By systematic development and working of the ore bodies, operating costs may be reduced to a minimum, and the installation of plant may be gauged to meet the requirements.



A View of the Tube Mills, Hollinger Mill

The above cut of "Transverse Section of Principal Workings" illustrates the occurrence of some of the more important veins. It is not possible to include all of the ore bodies in one cross section, and the above is merely to show how the veins continue roughly parallel at depth, and to give shareholders an idea of the amount of work which has to be done upon each level in the development of the numerous ore bodies.

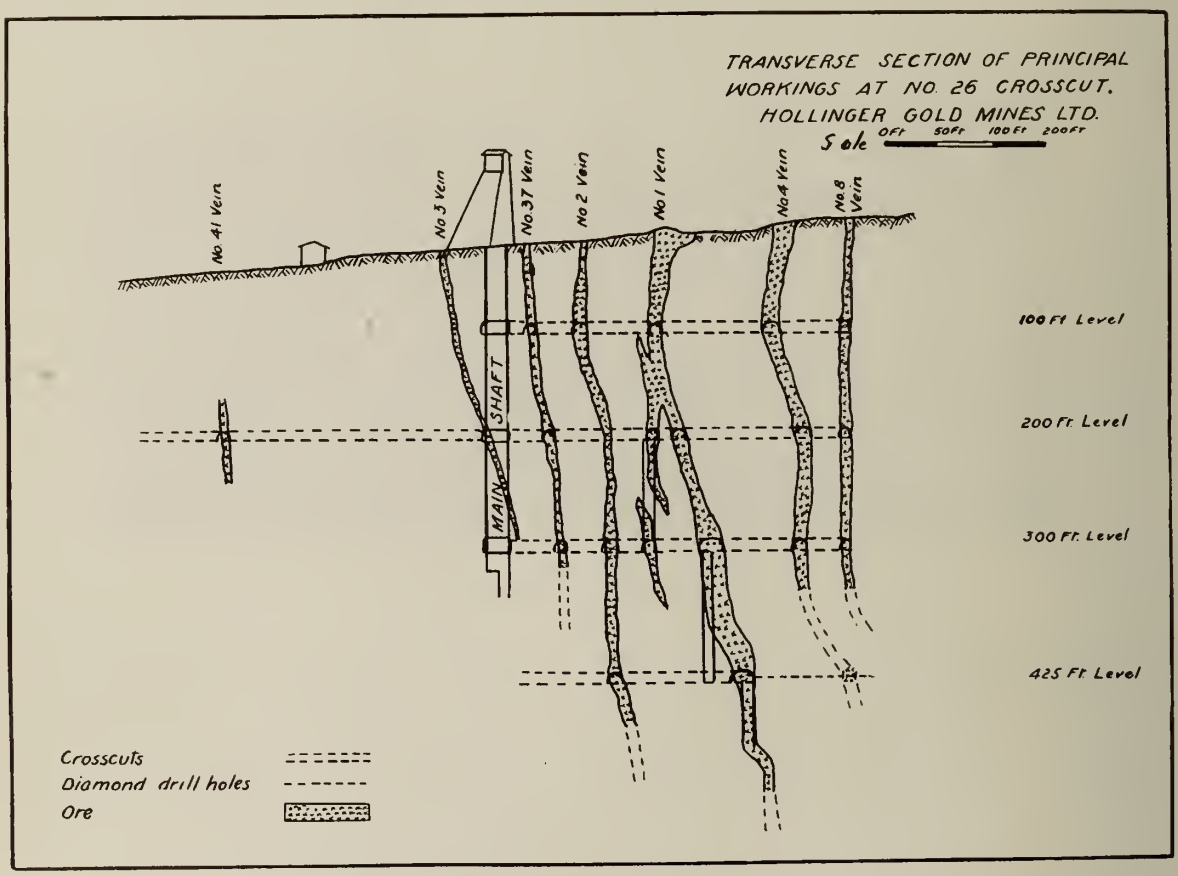
Speculative.—Beyond the limits of the estimates of proven ore, there are possibilities which cannot be disregarded.

For purposes of convenience in mining, and to facilitate the opening up of the lower levels, a winze has

been sunk to a total depth of 550 feet below the surface. This winze happens to be located at a certain point upon No. 1 Vein. There is no reason to believe that this is the only point to which this vein penetrates to the depth attained.

Level after level has been opened up, and unfailingly the veins have been found where sought for. It is not unreasonable, then, to forecast the possible results which will accrue if future exploration proves that the principal ore bodies persist without change to at least the level of our deepest workings, namely, 550 ft. below the surface.

Based upon this hypothesis the extra depth of ore bodies would account for the following additions to the estimates already given:



	Tons.	Value.
No. 1 Vein	53,400	$948,000
No. 2 Vein	158,400	1,862,000
No. 4 Vein	95,700	1,162,000
No. 5 Vein	56,300	626,800
No. 7 Vein	41,000	451,000
No 8 Vein	37,500	308,400
No. 38 Vein	33,500	539,600
	475,800	$5,897,800

We are located in one of the great pre Cambrian areas of the earth's crust, and the results of mining in similar rock formations cannot be ignored. Western Australia, Southern India, South Africa and Brazil have all contributed to a building up of knowledge concerning the occurrence of gold in deposits in these older rocks, and, as pointed out by Dr. Malcolm Maclaren, before the recent Canadian meeting of the International Geological Congress, gold deposits of this type are deep seated in origin and persist in depth until some unfavorable change in rock formation occurs to adversely affect the gold-bearing lode.

While it is true that such an unfavorable change in rock may at any time be encountered, either because of folding in the earth's crust or through the intrusion of rock masses, yet we are certain that such a change has not been encountered in the depth to which our workings have penetrated, nor has such a change been shown by the somewhat deeper diamond drilling which has from time to time been done in our vicinity.

The expectancy, therefore, that our principal ore bodies will all persist to at least the depth of our deepest working, is not unreasonable.

I anticipate that my critics of two years ago will again take me to task for daring to anticipate the future, but I must remind shareholders that provisions for increased milling capacity, additions to hoisting and air compressing plants, the housing of employees and their families, the planning of underground development, and the many other items which go to swell the Capital Expense Account, result from the anticipation of events which may reasonably be expected to transpire.

Milling Record.

	Hollinger.	Acme.	Total.
Tons of ore milled	138,291	1,840	140,131
Average value per ton	$18.56	$12.49	
Total values sent to mill	$2,566,414.59	$22,978.17	$2,589,392.76
Average tons per day			383.92
Per cent. of possible time run			86.3%
Average tons per 24 hours of running time			444.87
Stamp duty tons per 24 hours of running time			11.51
Values lost in tailings			$101,370.18
Values recovered			$2,488,022.58
Total values per ton in tailings			$0.723
Per cent. of total gold extracted			96.085%
Cyanide consumed per ton of ore			0.461 lb.
Lime consumed per ton of ore			2.422 lb.
Zinc consumed per ton of ore			0.663 lb.
Lead Acetate per ton of ore			0.0065 lb.
Tons of solution precipitated per ton of ore			3.164
Zinc added per ton of solution			0.209
Average value of pregnant solution			$5.612

Distribution of Milling Costs, Hollinger Mines, 1913.

Account.	Labor.	Stores.	Total.	Per Ton Ore Milled.
General Milling Charges	$6,068.26	$4,940.90	$11,009.16	$0.081
Superintendence	9,110.86	.....	9,110.86	.066
Tailing Disposal	1,103.60	1,011.15	2,114.75	.015
Heating	2,345.60	3,128.78	5,474.38	.039
Lighting	457.62	1,790.42	2,248.04	.016
Mill Power Plant	267.05	167.30	434.35	.003
Sampling	554.26	23.42	577.68	.004
Coarse Crushing	5,337.74	5,484.21	10,821.95	.078
Conveying	4,318.18	2,898.16	7,216.34	.051
Stamping	9,144.61	13,175.78	22,320.39	.159
Class and Tube Milling	6,427.24	23,835.23	30,262.47	.219
Concentration	5,550.71	3,769.88	9,320.59	.068
Handling Concentrates	1,131.70	1,397.10	2,528.80	.018
Retreating Concentrates	2,843.19	2,929.62	5,772.81	.041
Handling Pulp	1,716.76	2,765.14	4.481.90	.032
Thickening	2,297.83	1,799.13	4,096.96	0.29
Agitation	3,858.32	1,661.58	5,519.90	.039
Filtration	11,965.01	9,158.77	21,123.78	.151
Neutralization	913.13	1,710.12	2,623.25	.019
Clarifying and Precipitation	2,218.43	10,434.25	12,652.68	.091
Smelting and Refining	7,413.38	10.474.88	17,888.26	.120
Pumping Solutions	1,542.68	1,795.06	3,337.74	.024
Cyanide	44.43	10.750.63	10,795.06	.078
Cleaning up Mill	5,724.28	62.40	5,786.68	.041
Alterations to Plant	6,292.83	8,475.08	14,767.91	.105
Assaying	1,739.72	994.41	2,734.13	.020
Watchman	619.10	1.50	620.60	.004
Acid Washing	130.26	728.84	859.10	.006
Shovelling in Bins	837.30	.....	837.30	.006
Stables	60.71	192.44	253,15	.002
Shops	144.50	286.14	430.64	.003
	$102,179.29	$125,842.32	$228,021.61	$1,628
Less treatment charges on Acme Gold Mine Ore— 1840 tons at $3.00			5,520.00	....
			$222,501.61	$1.609

The detailed costs are based upon the total tonnage treated.

Based upon the tonnage of Hollinger ore milled, 138,256 tons, the total cost per ton was $1.609.

Besides treating 138,148 tons of Hollinger ore, the mill treated 1,840 tons for our neighbors, the Acme Gold Mines, Limited, a charge of $3.00 per ton having been made for this service.

The capacity of the mill has been gradually raised from 300 to 500 tons per day. Extensions are now under construction which will further increase the capacity to 650 tons per twenty-four hours. As pointed out in my report of one year ago, we have been experimenting along the lines of continuous decantation, and while the results of our own work, and that of one of our neighbors, seem to indicate certain economies to be derived, we shall proceed slowly before coming to any definite conclusions. Approximately $14,000.00 has been spent in making alterations to the mill during the past year, this whole amount having been absorbed in working costs. The treatment of concentrates is receiving special attention and certain changes now being planned will, no doubt, lead to a higher extraction being made of the values contained in the concentrates. With an extraction of over 96 per cent. as at present obtained, it will be understood that any benefits to be derived from changes can only be small in amount. A comparison of our milling costs during the latter part of the year with those obtained in other camps will show that the possible economies are gradually growing less. We hope, however, to show slightly improved results before the end of 1914.

General.

The work of the year has been handicapped by the poor showing made during the first five or six months.

The members of the staff have all felt the strain of the seven months' struggle with the labor unions, and the work of reorganizing, after the strike was called off, made still further demands upon their strength.

How well these demands were met, is shown by the record of steady improvement which has marked the work of the last six months.

The average working costs for the year were high, owing to the inefficiency of operations during the first part of the year, but the last few periods show more nearly what may be anticipated in the way of working costs in the future, the average being approximately:

General	$0.90 per ton
Mining	2.87 per ton
Milling	1.44 per ton
Total	$5.21

Underground operations will be cheapened by better arrangements for tramming and by hoisting with skips instead of cages.

Milling costs will be reduced as the tonnage treated increases, and general charges will show a decrease per ton when spread over a larger tonnage than at present.

All things considered, it is probable that the total costs of production and treatment will be reduced to about $4.50 per ton. The reduction, however, will be gradual and can only follow upon increased output.

Our mining and milling plants are being gradually worked up to larger capacities, to keep pace with developments in the mine, but it is intended that all steps shall be taken slowly, for the property is now in such excellent condition that we can afford to expand operations at a conservative rate.

INTERNATIONAL ENGINEERING CONGRESS, 1915.

In connection with the Panama-Pacific International Exposition in San Francisco, in 1915, there will be an International Engineering Congress, in which engineers throughout the world, represeting all branches of the profession, are invited to participate.

The Congress is to be conducted under the auspices of the following five U.S. National Engineering Societies, namely: The American Society of Civil Engineers, the American Institute Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the Society of Naval Architects and Marine Engineers.

The organization and conduct of the Congress have been placed in the hands of a Committee of Management consisting of the Presidents and Secretaries of these five Societies, and of eighteen other members representative of them and resident in or near San Francisco.

The Honorary Officers of the Congress will consist of a President and a number of Vice-Presidents, selected from among the most distinguished engineers of the world.

Colonel George W. Goethals, Chairman and Chief Engineer of the Isthmian Canal Commission, has consented to act as Honorary President of the Congress, and is expected to preside in person over its general sessions. The names of the Vice-Presidents will be announced in the near future.

The Congress will hold its sessions during the week, September 20-25, 1915, in San Francisco, in the auditorium and section rooms which will be placed at its disposal by the management of the Panama-Pacific International Exposition Company.

Two distinct, though perhaps equally important, purposes of the Congress should be here emphasized. These are:

The gathering together of a large and representative body of engineers from all civilized countries, with the opportunities which this will present of forming or renewing personal acquaintances, and of interchanging views on the various phases of professional work.

The reading and discussion of papers before the various sections, and their later publication in such form as to constitute a valuable addition to any engineering library.

In scope and character, it is intended that the Congress shall be truly international, and that it shall embrace, in a thorough and comprehensive manner, the various branches of the engineering profession. Eminent engineers throughout the world will be invited to contribute papers on assigned topics, and in the selection and distribution of these topics the Committee will use its best endeavors to render the series of resulting papers widely representative of the world's best engineering practice in the various branches of the profession.

COBALT-FRONTENAC.

The Cobalt-Frontenac Mining Co., Ltd., announces that it has let a contract for 1,000 ft. of diamond drilling to Messrs. Smith & Durkee, of Sudbury. The drilling is to begin at once, both at surface and underground. Mining operations have been suspended, pending an increase in water supply.

THE SUCCESSFUL TREATMENT OF ZINC SULPHIDE ORES

By Frank L. Wilson.*

Treating the heavy sulphide ores for the extraction of their zinc content has been experimented upon insistently. Numerous more or less successful processes have been invented and some tried out. Some have been tried on a large commercial scale, failing with a loss of considerable invested capital. These processes have been advertised throughout the metallurgical world, and, in their fall have carried away many enthusiastic supporters and created a rather harsh feeling toward new ideas. Some have again risen to noteworthy prominence.

An Ammonia Process.—Most hydro-schemes for treatment of zinc ores are acid. And now an alkaline scheme presents itself. This scheme using ammonia and carbon dioxide in solution was one of the discards, as it were. Dr. Carl Schnabel first describes it ("Hand Book of Metallurgy," Vol. 1, p. 677-680), as installed at Lautenthal and later at Hoboken-les-Anvers for the treatment of the zinc-lead-silver crust produced in the Parkes process. The scheme was abandoned at these two plants because distillation of this crust was installed and proved to be cheaper.

During the stage of experimentation at Broken Hill, when the sulphides were encountered, Dr. Schnabel was called to Australia for consultation. He unsuccessfully tried this scheme on the ores and returned to Germany without accomplishing that end.

S. E. Bretherton, in looking for a process to treat the Afterthought ores of Shasta County, California (see "Smelting of Zinc-copper Ores," Mining and Scientific Press, April 12th, 1913), made a series of leaching tests with ammonia and carbon dioxide in solution. D. Mosher, who was at that time interested in his ammonia-cyanide process (see "Ammonia-cyanidation and the complex zinc problem," Mexican Mining Journal, August, 1910), suggested the use of it.

The writer in the spring of 1912, obtained some Afterthought ore and made several interesting and satisfactory tests with this process. Several schemes presented themselves whereby the troubles that Schnabel encountered could be overcome. As a result of these satisfactory tests, active experimenting was started at the Afterthought mines. Here, a preliminary 25 lb. plant and later a 50 lb. testing plant were erected. The results (see "Preparation of ore containing zinc for the recovery of other metals such as silver, gold, copper and lead by the elimination and subsequent recovery of the zinc as a chemically pure zinc product." Trans. A.I.M.E., Vol. XLVI.), checked those obtained from the smaller bottle tests in a most satisfactory manner.

The Ore, and Method of Treatment.

Ore from the Afterthought mine is a complex 'black jack,' composed of intermixed zinc blende, chalcopyrite, a trace of galena and silver sulphide, iron pyrite, barytes, calcite, etc. The ore averages from 20 to 30 per cent. zinc, running as high as 40 to 45 per cent. zinc.

The ore is crushed and ground to pass 30 mesh. It is then given a sulphatizing roast in a multiple hearth furnace and then slimed to pass 150 mesh. This slimed ore is then mixed with a 4:1 solution containing approximately 9 per cent. ammonia (NH_3) and 9 per cent. carbon dioxide (CO_2) and agitated under pressure until the solution is saturated, or nearly so, with zinc salts. It is then filtered and the residue given a wash, first with strong solution and finally with hot water to remove traces of ammonia. The solution from the agitator after filtering passes to a tank where it comes in contact with scrap zinc or zinc dust. Any copper or silver that has been dissolved is precipitated as cement copper. Again filtering this solution and removing the cement, the solution is sent to a battery of specially constructed stills where the ammonia and excess carbon dioxide is boiled off with steam and caught in absorbers. The zinc precipitates as a white basic carbonate and is caught in an enclosed type filter press. It is either sold as the basic carbonate or calcined to an oxide. This oxide has been pronounced by experts as of the best for paint body. The cement copper can be sold for pigment or added to the residue to be smelted in a matting furnace.

Recovery, Etc.

Extractions of the zinc vary with the percentage of the zinc in the original ore. That is, the higher the zinc in the ore the greater the extraction. On a 20 per cent. zinc ore the extraction varies from 82 to 89 per cent. and on a 30 per cent. zinc ore 87 to 95 per cent. The recovery of the zinc as basic carbonate on several complete tests was 100 per cent. and as all solutions and wash waters are used over again, any trace of zinc remaining in them will ultimately be recovered.

With copper, to get a maximum extraction requires a slightly different roast and a longer contact with the leaching liquor. As high an extraction as 90 per cent. has been obtained, from an ore assaying 2.96 per cent. copper, without careful roasting. Even higher than this has been obtained when care is taken. At the Afterthought mine, where the copper is to be added to the residue and smelted, the extraction averages about 55 per cent.

Lead and silver are only slightly soluble. Where care is taken in roasting the extraction of these metals is practically nil.

Ammonia losses are only what is mechanically held in the gangue matter of the residue. This varies from 1 to 5 pounds per ton of ore in the tests run. By preheating this residue and drying, most of the ammonia held back could be recovered.

The residue is only from 46 to 56 per cent. of the original ore and the cost of smelting reduced that amount.

The cost of operation compares favorably with any known process for zinc recovery. The initial cost of the plant is extremely low, as compared with an electric furnace or retort plant. The recovery of metals is greater. The plant itself has been worked out on the simplest design and contains no complicated or large dimensional machinery.

The apparatus and the more important features of the process described above are covered by patents, controlled by Consulting Engineer, S. E. Bretherton, of San Francisco.

There are many mines lying idle to-day, which contain ore similar in character to the 'black jack' ore of the Afterthought, waiting for some method of concentration and extraction to work them profitably. The method of procedure with this process is simple. No expensive lead lined tanks and apparatus is necessary. They need be only gas tight to retain the volatile ammonia. Wooden tanks can be used for the weaker solutions.

*Metallurgical Chemist for the Afterthought Copper Company, Ingot, Shasta, County, California.

CANADIAN NORTHERN RAILWAY MOUNT ROYAL TUNNEL*

By D. J. O'Rourke.

Tunnel Methods.

When the Canadian Northern Railway, headed by Sir William Mackenzie, President; Sir Donald Mann, Vice-President, and Mr. H. K. Wicksteed, chief engineer of survey, decided that the most advantageous way of entering Montreal was by a double track tunnel under Mount Royal, all modern methods of tunnel driving were carefully investigated. As time was a great factor, more rapid methods were sought than those afforded by earlier American examples.

They were fortunate in securing the services of Mr. S. P. Brown, a tunnel engineer of many years' experience, who had, on trips to the Swiss and Italian tunnels, studied their methods closely. Mr. Brown was given entire charge as managing engineer, to construct the tunnel on the plans he outlined; and as a matter of record he has made no changes in those plans in getting the satisfactory results he has obtained up to date.

He selected as his most important assistants on this work, Mr. W. C. Lancaster, electrical and mechanical engineer; Messrs. J. C. K. Stuart, first assistant engineer, and H. T. Fisher, tunnel engineer; Mr. Richard Byers, superintendent at the west portal; Mr. P. J. Morante, superintendent at east portal. Mr. Morante resigned the 1st of April to enter the contracting business for himself. Mr. Edward Duffy succeeded Mr. Morante as superintendent at the east portal and made the record for tunnel driving referred to later in this article. Mr. Rufus Gent was appointed master mechanic in full charge of the electrical and mechanical equipment under Mr. Lancaster.

The plan on which Mr. Brown decided to drive this tunnel, while partly on the European system, is not entirely so. He adopted a bottom heading, according to foreign practice, and in one heading is using a drill truck or carriage, another European feature. The drills are mounted on arms, supported by a heading bar.

The mountings and drilling round are described later. His method of excavating the rock above the heading is being used for the first time in this class of work on the Mount Royal tunnel. The rock above the heading is supported on Jumbo timbers set up as shown. The rock is removed by "break-ups," or raises, carried up to roof grade at intervals and used as starting points for widening the tunnel out to its full section.

This timber is taken down and moved ahead as the break-up advances. This system permits practically all the rock in the tunnel section above the heading to be loaded by gravity, greatly reducing the amount of time and labor needed for its removal.

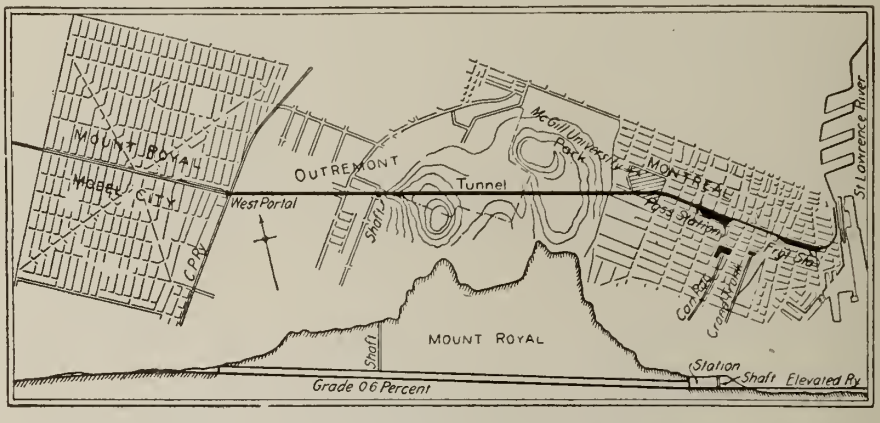


Fig. 1—Plan and Profile, Mount Royal Tunnel

General Plan of Work.

The map shows the general layout of this work. It was originally intended to sink three shafts. Shaft No. 1 in the station site on Dorchester St.; Shaft No. 2 on the side of the mountain above McGill College, and Shaft No. 3 at Maplewood Ave. in Outremont. As a site for Shaft No. 2 could not be secured, it reduced the possible working faces to four, which, since April 5th, when the heading between the West Portal and Shaft No. 3 met, are reduced to two working faces.

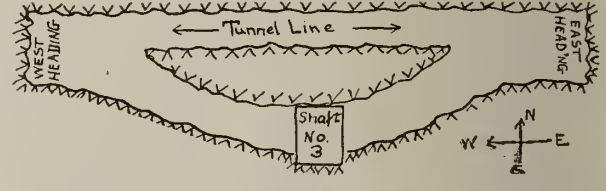


Fig. 2—Method of reaching the tunnel line at Shaft No. 3

West Portal Heading.

Ground was broken at the west portal in the heading, known as No. 4 East, having cross-section 8 x 12 ft. on July 8, 1912, and the first set of timber placed in the portal on that date. The character of the ground encountered was wet hardpan with many boulders, and springs of water were frequently struck that gave considerable trouble, particularly where they burst up around the timber, requiring the placing of a new set.

*From "Mine and Quarry," Published by the Sullivan Machinery Co.

Fig. 4—Widening the tunnel in a "break-up," entry in centre, column drills at sides

Fig. 3—A "break-up," showing bottom heading, timbering and top excavation above

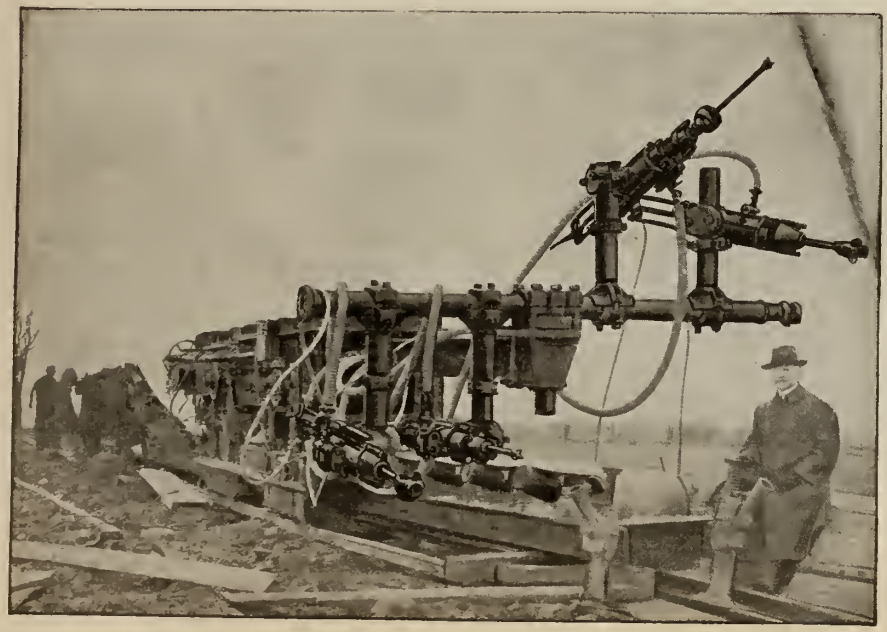
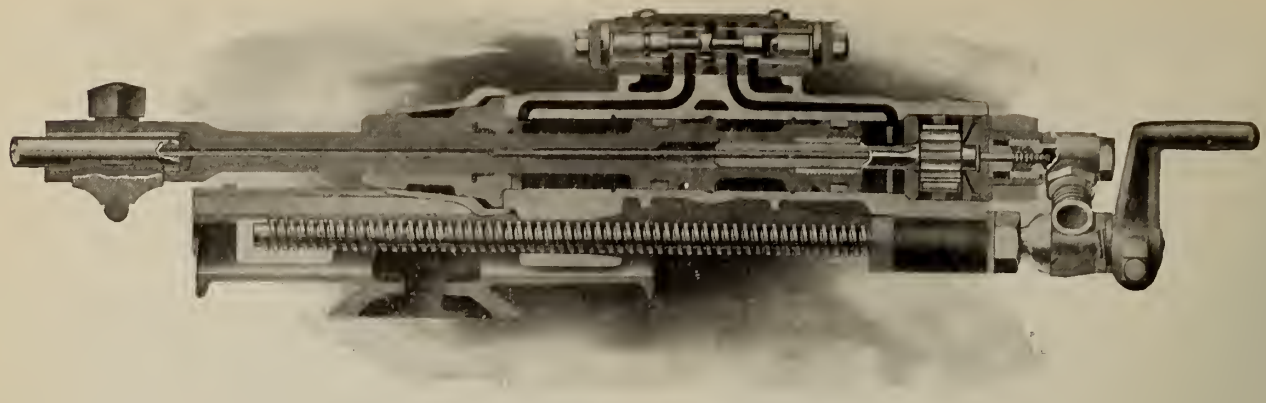


Fig. 8—Drill carriage and conveyor, with Sullivan "UH-2" ($3\frac{5}{8}$in.) Water Drills

Fig. 10—Where the headings met, after an advance of 1,100 feet per month



Sectional View Sullivan Water Type Rock Drill

At about 100 ft. from the portal the heading crossed under the Canadian Pacific Railway tracks, and great care had to be exercised to prevent caving at this point. The total advance on August 31 was 301.2.

About August 8 rock was struck at sub-grade, and the heading continued to be rock and hardpan until September 6. Up to this date the timber was carried up to the heading face.

Arrangement of Drills and Holes.

After the rock was reached the timbering did not interfere so much with the work, but the rock, which lay in horizontal strata, was very blocky and difficult to drill and blast. When rock was reached, bars 11 feet long, four inches in diameter, carrying special arms for mounting the drills, were used. A special arm or brace, having a jack screw at its outer end, was clamped to the centre of the column, of sufficient length to allow it to be jacked against the face of the heading, giving the necessary stability to the bar.

In setting up, the muck was raked down so that the bar was placed about three feet from the roof, or one foot above the centre of the heading, and four Sullivan "FF-12" "Liteweight" Water Drills, (2⅝-in. diam.), were mounted on the bar. The heading was drilled as follows: Four roof, two cut, two relief and two rib holes were drilled with the arms above the bar, and four cut, two relief and two rib holes were drilled with the arms below the bar, making a total of 18 holes in each round. This was changed somewhat from time to time, depending on the character of the rock; for considerable periods 22 holes were necessary to break the heading satisfactorily.

From the first of October until April 5, at which time this heading met the heading coming west from the shaft, a total period of six months and five days, the heading advanced 2,469 ft., making an average advance per month of 411 ft., with a maximum advance for November of 486.7 ft. During this time the crews worked only every other Sunday and several days' work was lost around Christmas and New Years.

In driving this distance the rocks cut were ordinary Trenton limestone, a siliceous and hard crystalline limestone, and camponite. Considerable trouble was experienced in maintaining a uniform drilling and blasting system, due to dikes of extremely hard rock. This made it necessary to change the rounds drilled from five to three, and in some few cases only two rounds were gotten in 24 hours. Sullivan "UH-2" Water Drills (3⅝-in. diam.) were put in and retained till the heading was holed through.

Maplewood Avenue Shaft. No. 3.

Being unable to secure property rights on the tunnel line, this shaft was sunk about 40 ft. from the line, and the tunnel line was reached by the plan shown above.

The dimensions of this shaft are 12 x 24 ft. outside the timber, and it reached grade at a depth of 242 ft. At a depth of 69 ft. the section was reduced to 12 x 16 ft. in the clear and required no further timbering.

On July 21, 1912, excavation was started on this shaft, which, together with the west portal, was under the superintendence of Richard Byers, with Edward Farrell as walking boss.

From December 1, 1912, until April 1, 1913, the No. 2 heading, west-bound, having a cross-section of 10 x 12½ ft., and using five "FF-12" (2⅝-in.) Sullivan drills with water attachment, made an average advance per month of 445.5 ft. and met the west portal heading on April 5.

Heading No. 3 East, driving from the shaft under Mount Royal to meet No. 1 West from Dorchester Street, struck very hard rocks (known as essexite and camponite). Sullivan "UH-2" (3⅝-in.) drills, using a cross bar with arms for mounting the drills, were used.

Drill Carriage and Conveyor.

Knowing that this hard rock would be encountered, Mr. Brown decided early in the work to use a drill carriage for mounting heavy drills. He also knew from experience that a carriage merely for carrying the drills, which necessitated removing it after the bar was jacked in position, or allowing it to remain in the heading, in which case it could not but interfere with the mucking, would not answer his purpose.

A Trip Through the Heading

He therefore had his mechanical department build one to suit his requirements. This has an arm carrying the cross-bar and drills, which may be advanced about 20 ft. ahead of the frame; also a belt conveyor supported on a movable frame, which may be advanced eight or ten feet ahead of the frame proper, so that the end of the conveyor belt may be kept close to the muck pile. After each shot is fired the muckers go ahead of the machine and throw the muck off the track, which is riveted on to a steel plate until the machine gets close enough to the heading to position the bar carrying the drills, the heading being drilled from one position of the bar.

The accompanying illustration gives a fairly good idea of the construction of this carriage, as it was being tested out before it was put in the tunnel, except that there is a hopper arrangement around the front end of the belt, not shown in the picture. Muck can be shovelled on to the belt at any point back to where it rises to convey the muck to the horizontal belt, which in turn delivers it into the car, openings being left in the frame for that purpose.

four are in operation between Shaft No. 3 and the west portal.

Fig. No. 4 shows the face of this break-up and the method of advancing it. An entry is broken down on top of the timbers, the first holes next to the timber being shot light, with the charge increased after the second shot. In this way this entry is carried to the roof grade. A cross-car mounting four of the 2⅝-in. drills before mentioned is used in the entry, and 10-ft. holes are drilled. This requires two setups of the bar, the drillers standing on the loose muck when drilling the top round.

This entry is carried ahead of the wings only a sufficient distance to allow setting up the bar to drill the succeeding round. A double screw column with arm, mounting one drill on each column, is kept at work on each wing, and corresponding rounds on each wing are shot together, a system which keeps the bulk of the muck at all times on the top of the timber, from which point, by removing the lagging, it rolls practically by gravity into the cars.

Fig. 6.—Sullivan Liteweight (2⅝-in.) Rock Drills on an 11-ft. heading bar in the Mount Royal Tunnel

The combined carriage and conveyor was started in Heading No. 3 East on May 5 last, and some idea of its advantage may be gained from the following figures:

From December 1, 1912, until May 1, 1913, a period of 5 months, the average monthly advance was 344.2 ft., the advance for the month of April being 351.4 ft. (without carriage). During May the 10 x 12.5-ft. heading was advanced 510 ft. in 27 working days, in itself no mean record. This was done in extremely hard rock and the muck was all removed as soon as, if not before, the drilling was finished.

There has been no delay due to this machine since its installation, which is a remarkable performance for a new machine for tunnel work.

Break-up Excavation.

Fig. No. 3 shows clearly the method of setting the Jumbo timber in the break-ups (see page 731), of which

Shaft No. 1, Dorchester Street.

Shaft No. 1, at Dorchester Street, is located in Montreal's busiest section, and the tunnel line passes under both the business and residential sections, which caused the blasting in the heading to be greatly restricted. No shooting was allowed between 11 p.m. and 7 a.m.

This shaft started August 3, 1912, and was broken 14 x 22 ft. outside the timber; grade was reached in about 5 ft. of rock on August 29 at a depth of 46.2 ft.

No. 1 Heading West.

After the usual delay of installing head house, cages, and pumps, actual work was begun about September 5, in the heading, which continued to have earth and bad rock in the roof for a distance of 1,200 ft.

Including all delays, no Sunday work, and no blasting allowed between 11 p.m. and 7 a.m., and counting a full working month for September, 1912, on April

30, 1913, a period of eight months, this heading had advanced 2,912.3 ft.; the advance for February being 374 ft.; March, 517 ft.; April, 507 ft.

810 ft. in 31 Days.

At this time they were under a heavy cover of rock, and Mr. Brown decided to take off all shooting restrictions on May 1 and let the men, who were chafing at the restraint on the shooting, go ahead and see what they could do. So at midnight, April 30, the 12 o'clock shift started with a test run of 27 days in view. As the work progressed it was found that record runs were being made, and it was decided to make the limit of this test 31 days.

As no work was allowed on Sunday, except the last Sunday in May, when the men took a chance, the run was finished at midnight, June 4, making a total advance of 810 ft., an average of 26 ft. for each 24 hours.

Eight hundred and ten ft. of 8 x 12-ft. tunnel in 31 consecutive working days (three shifts), constitutes a record for tunnel driving with percussive rock drills that has never before been equalled on this continent. It also constitutes a world's record for excavating a tunnel in hard rock.

Four "FF-12" Sullivan Reciprocating, Percussive drills with water attachment, using hollow steel 1⅛-in. in diameter, through which alternate pulsations of air and water are forced to the bottom of the hole, were used in this heading, and the drills were mounted as shown.

Steel Used.

It will be of interest to learn that there was practically no breakage of the steel, due undoubtedly to the reciprocating action of the drill. Hollow steel, when subjected to hammer drill action (which, until the Sullivan reciprocating water drill was put on the market, was the only type of rock drill that used hollow steel), must have more or less breakage.

"FJAB" steel was used, made up in 22-in. changes; about 500 sharp steels were used each 24 hours. When the hard dikes were numerous, this number was greatly exceeded. The gauges were as follows:

No.	Cuts to in.	Gauge in.
Starter	22	2¼
No. 2	44	1⅞
No. 3	66	1⅝
No. 4	88	1½
No. 5	100	1⅜

The No. 5 was rarely used, and the gauge of 2¼ in. on the starter was used to give more freedom at the collar of the hole, also making it easier to remove the steel. The size of hole required at the bottom was only large enough to receive 1¼-in. dynamite.

The Holes.

The sketch shows the usual layout of the holes drilled when 22 holes were used, which was most frequently the case, although the heading has been shot with 20 holes, and in a few cases with 18 holes. The placing of the holes and the set-up of the bar is as described.

Contrary to the practice usually described on work of this kind, no regularity in depth of holes was possible, due to the character of the rock. A long round of 6 or 7 ft., at times alternated with a short round of 4 or 5 ft., and great credit is due to the men for the judgment used in the number and depth of holes required for each round. Usually 6 rounds were drilled and shot each 24 hours.

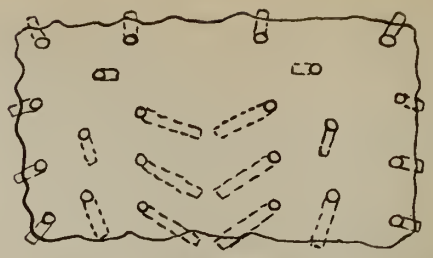


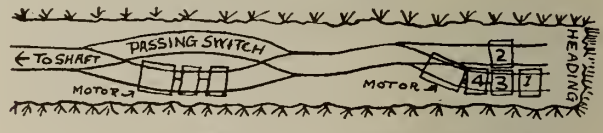
Fig. 7—Mount Royal Heading, 22-hole round

Powder.

Forcite dynamite of 60 per cent. strength was used, and exploded by No. 8 electric exploders, comparing in strength to Canal Specials, and the round was fired from the wires used for lighting the heading, at a switch generally kept at about 700 ft. from the face, and on the opposite side of the heading from the lighting system. The amount of dynamite used in each round varied, and it was found necessary to shoot the cut twice before it broke to the bottom. Occasionally the relief holes were shot with the second shot in the cut, but quite often the old guns left in the cut were loaded the third time and shot with the relief holes.

Mucking.

Two temporary rails were laid on their sides, the ball of each locked under the ball of the permanent rail, and on top of these temporary rails slick sheets were laid. The slick sheets were raised and the temporary rails, which were 30 ft. long, were advanced each round, and the slick sheets pushed forward and relaid and covered with sufficient muck to prevent the shot from lifting them. Seven muckers were used on each shift of eight hours. It was the duty of three of these men to work back the muck from under the bar onto the slick sheets, and the other four men, shoveling entirely from the slick sheets, loaded the entire excavation into the cars, making over eight yards of muck in the solid (or 15 yards in the loose) per man per eight-hour shift, for the four men mucking off the slick sheets.



Fig, 9—Arrangement of Tracks and Cars

The accompanying sketch will in a manner explain the handling of the cars, which were of 40 cu. ft. capacity and built by the mechanical department on the work. A passing switch has always been maintained as nearly as possible halfway between the shaft and the heading, and two storage battery locomotives were used. Two cars were kept at the heading, and before each round was fired they were pushed back as far as the shooting switch, so there were no obstructions in the way of the men when coming from and returning to the heading after each shot. When the last shot was fired, the cars were pushed back by the men as they went in, and were placed in position, (No. 1 and No. 2 sketch). Car No. 1 on spur track was loaded first, Car No. 2 on main track being left back a slight distance, to allow the muckers room to work in. By this time the locomotive with two empty cars, Nos. 3 and 4,

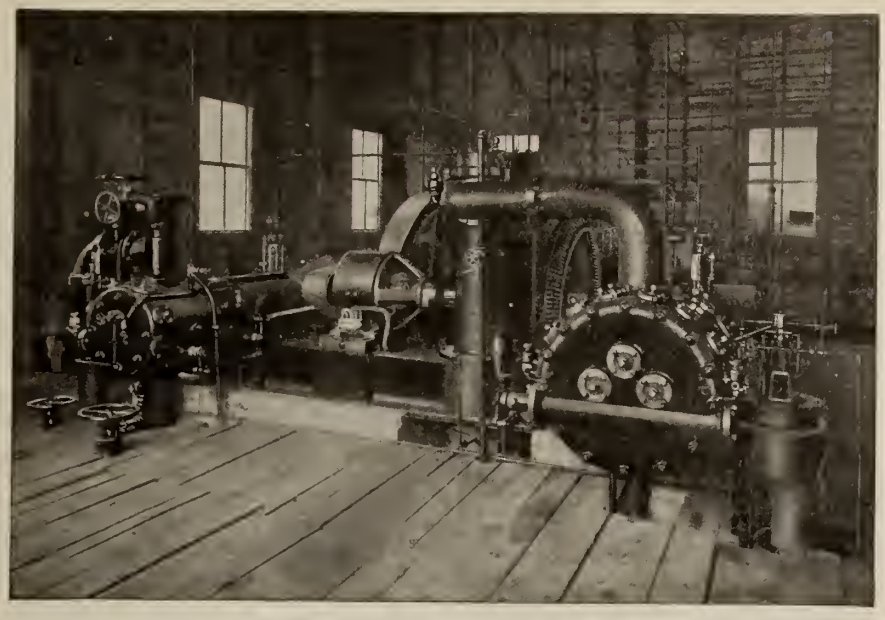


Fig. 14—One of the two Sullivan Class "WN-2" direct-connected motor driven air compressors at the Mount Royal Tunnel

comes in and couples on to No. 1, which, as soon as loaded, is run back and pushed in behind No. 2, which has been pulled up to the muck as soon as No. 1 is loaded, the muckers hooking their shovels over the end of the car to pull it ahead. The locomotive then returns empties Nos. 3 and 4 to the spur track, shifting back and picking up 1 and 2, now loaded, and proceeding to the shaft. The men start loading No. 3, and a man called the car wrangler pushes No. 4 back and switches it in on the main track to the position of No. 2, as shown in the sketch.

The locomotive, with two empties that have passed the loaded cars at the passing switch, then comes in and repeats the operation. It can be noted from this system of handling that no time is lost by the muckers in waiting for cars, and the spur track is changed frequently to reduce the switching distance.

Air Compressors.

The air for operating the entire outfit of Sullivan drills, now in use on this work, and the hammer drills used for putting in holes for centre plugs, and for sup-

Fig. 11—Mount Royal Tunnel, Carriage in Heading No. 1 West

ports for ventilating pipe and light wires, is furnished by two direct connected compressors of Sullivan "WN-2" type, 2,000 ft. capacity at 100 lb. pressure. One is located at each end of the work, and in each plant, in addition to the direct connected compressor, are three Blaisdell belt driven units of about 1,100-ft. capacity, making a total of 5,300 ft. of air at each end of the tunnel.

When it is considered that in driving this 810 ft. of 8 x 12-ft. heading, the crew at Mount Royal drilled a total of 20 per cent. more holes and excavated a total of 18 per cent. more hard rock than was excavated in the Loetschberg tunnel in driving 1,013 ft. in soft rock, a world's record can hardly be disputed for tunnel driving where air driven percussive drills were used.

Meeting of Tunnel Headings.

The tunnel crews shattered the last barrier between the two headings at seven o'clock on the morning of December 10th.

ite and syenite were among the kinds of rock encountered, sometimes singly, sometimes in combination.

Drill Carriages.

Drill Carriages.—Heading No. 1 West ran into harder and harder rock after June 1st, and the 2⅝-in. drills were replaced, about three months later, with 3⅝-in. "UH-2" machines, for which a tunnel carriage with cross-bar was built, similar in principle to that previously designed for Heading No. 3 East, but modified in form and without the muck conveyor.

A large saving in time was gained by the use of these carriages, as compared with mounting these heavy drills on a bar or columns. This is indicated by the average monthly progress in No. 3 East heading, which rose from 350 ft., prior to the installation of the carriage, to 485 ft. afterwards.

The carriage with the drills on it in No. 1 West heading (without conveyor) was run back to a siding after each round, to permit the passage of cars to the face.

Fig. 13—The Mount Royal Tunnel; timbering for the heading and completed "break-up." Bench not Removed.

From the starting of the real tunnel excavation on September 6, 1912, to the time of holing through was fifteen months and four days, a splendid record of progress. The tunnel is 3¼ miles long, and the headings were driven 8 by 12 ft. (No. 1 West), and 10 by 12 ft. (No. 3 East) in size.

The average monthly progress per heading for the entire work was 420 ft.

When the wide range in the character of the rock is considered, the engineering skill and resourcefulness and the thoroughness and efficiency of the working organization exhibited by this consistently uniform and rapid progress, are remarkable. Certain it is that a more varied assortment of hard rocks has seldom been encountered in any one instance in the history of American tunnel work. Trenton limestone, hard siliceous crystalline limestone, hard igneous intrusions, or dikes of bostonite, camptonite, volcanic breccia, essex-

The girder or arm was there supported by a pipe hanger, carried by "A" frames at each rib.

Four "UH-2" 3⅝-in. drills were regularly mounted on the cross-bar of the carriage, and the whole round of 20 to 24 holes was drilled from a single setting of the carriage.

Owing to the great hardness of the rock, the holes were carried to as great a depth as the proper breakage of the ground would allow. Cut holes were drilled 8 ft. and rib holes 6½ ft. deep. This gave an advance of 5½ to 6 ft. per shift. After the round had been drilled, shot and muck cleared away, if the shift was not over the crew, working on the bonus system, would run the carriage to the face again and start the new round before the next shift began. In this way a round was gained on an average every 48 hours, or seven rounds were put in in six shifts, giving an average advance per working day of 19.2 ft. of single heading.

The engineers of the tunnel contractors, Mackenzie, Mann & Company, Ltd., estimate that the tunnel construction will be completed by the latter part of 1914. About 1½ miles of break-up excavation above heading grade are now done. The entire break-up will be finished by about May 1, 1914, after which the bench at each side of the heading will be removed, thus completing the section of the tunnel to its full area of 31½ x 21 ft.

The tunnel will probably not be lined throughout with concrete, but only in sections where the rock requires it. A large part of the tunnel length is driven through rock so hard and firm as to require no finish of this sort.

The Mount Royal tunnel is notable for the variety and hardness of the rock encountered; for the fact

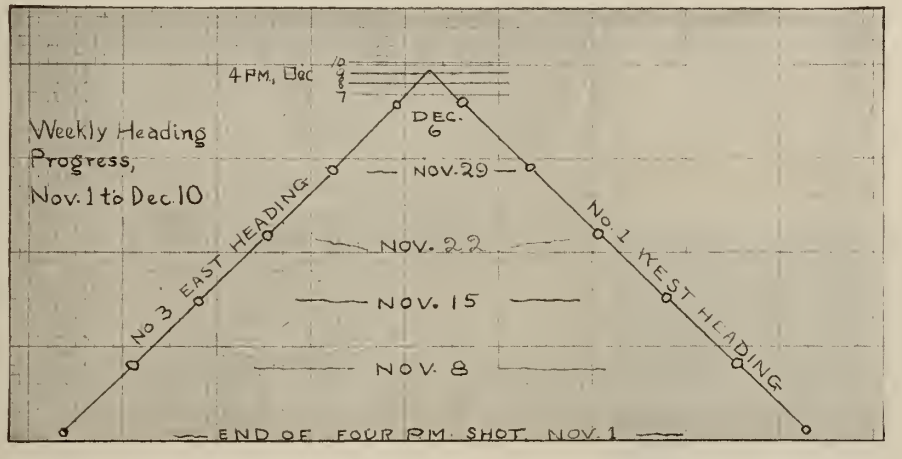


Fig. 12—Progress Chart for November and December (a rough copy of the original)

that it is the first of American tunnels to use a bottom pilot heading, with the break-up system of enlargement carried on jumbo timbers, thus permitting muck cars in the heading below to be loaded by gravity; for the first use of reciprocating type rock drills with hollow drill steel and water jet attachment; for the most rapid heading advance ever recorded for hard rock; for the first American use of a drill carriage and muck conveyor, and for the first American example of the practice of drilling shallow holes instead of deep ones, in a tunnel of so large heading area and over so long a period. It is also notable for the small loss of life attendant upon its construction thus far.

Government figures show that 4.7 men are killed per thousand engaged in tunnel work. In metal mining in the United States 4.3 per thousand lose their lives, and in coal mining 3.7. In building the St. Gothard Alpine tunnel 800 men were killed in eight years; at the Simplon, the latest of the great tunnels between Switzerland and Italy, 67 men out of 900 were killed in seven years' time.

At Mount Royal about 1,000 men are employed. Thus far only a single man has been killed in the tunnel proper, during the fifteen months' work, and this man did not lose his life in the headings.

These accomplishments speak highly for the quality of engineering ability and of the organization and methods employed in prosecuting this interesting undertaking.

The writer is indebted to Mr. S. P. Brown, managing engineer for Mackenzie, Mann & Company, and to his assistants for the information and pictures used in this report.

NIPISSING.

The decline in Nipissing to 6 3/16—at which price current dividends return an income of 23 per cent.—is due to the growing conviction that a reduction in the $1.50 dividend rate is near at hand.

There has been a recent drop in earnings, due to a rather significant decline in output. Figures of monthly operations during the last half of 1913—figures not heretofore published—show this declining tendency.

	Ounces.	Gross value.
July	380,372	$224,216
August	376,374	222,360
September	315,159	191,753
October	363,168	218,772
November	283,531	159,220

The company is fairly well fortified as to cash, but during the six months from June 30, 1913, to Dec. 31, 1913, there was a drop of $240,000 in the cash surplus, or from $1,484,000 to $1,244,000, as seen below:

Quarter ending	Cash surplus.
Dec. 31, 1913	$1,244,000
Sept. 30, 1913	1,384,000
June 30, 1913	1,484,000

It is apparent from the above that in its annual report for last year Nipissing will show that its dividend disbursements were not met from the earnings of last year.—Boston News Bureau.

BRITISH COLUMBIA COPPER CO.

British Columbia Copper Co. new financing will, according to present plans, be accomplished through a new company to be formed with $5,000,000 stock and $1,000,000 6 per cent. 10-year convertible debentures. The bonds will be offered to British Columbia stockholders for subscription at par on the basis of $1 in bonds for every share held. As the British Columbia Co. now has 600,000 shares there will be raised through this method $600,000.

The issue will be underwritten and for their services the underwriters will get an option on the treasury bonds which will carry a stock bonus.

The management plans the erection of a 1,000-ton concentrator to handle the ores from recently acquired and developed properties. Concentrates will be shipped to the present smelter.

Should new financing be needed beyond that to be arranged for at this time it will doubtless be through the medium of a stock issue.—Boston News Bureau.

OBITUARY

Major Robert Gilmour Leckie, who may almost be described as the father of mining engineering in Canada, died at Sudbury, Ont., on November 5th last, in the eighty-first year of his age. Major Leckie was born in Renfrewshire, Scotland, on August 23rd, 1833. He came of fine old stock, being the representative of the ancient Stirlingshire family of Leckie of that ilk. He was educated at the Glasgow High School and Glasgow Technical College. He came to Montreal at the age of twenty-three, and for a time was associated here with a shipbuilding enterprise. Very shortly thereafter, however, he became interested in mining, first in the Eastern Townships of Quebec, and later in Nova Scotia. In the Eastern Townships he was associated with early copper mining effort, and also held an interest in nickel properties in the Township of Orford, which were acquired subsequently by Boston capitalists, headed by Mr. W. E. C. Eustis, who organized a company first known as the Orford Nickel Company, then as the Orford Nickel and Copper Co., and finally the Orford Copper Company, which again, after a lapse of time, was merged in the International Nickel Company. Major

The Late R. G. Leckie

Leckie was for some time managing director of the Orford Nickel Company. In Nova Scotia he was associated with numerous coal and gold mining enterprises, and about the year 1880, was responsible, in association with the late William Hedley, of Halifax, and Senator Senecal, of Montreal, for the consolidation of the coal companies operating in the neighborhood of Springhill, in Cumberland county, with the Springhill & Parrsborough Railway Company, thus forming the Cumberland Railway & Coal Company, of which he became managing director. Under his direction, this undertaking from modest beginnings presently grew to great importance, attaining an output of 500,000 tons of coal per annum. Again during Major Leckie's regime at Springhill, the Provincial Workmen's Association—or coal miners' union—was organized in Nova Scotia; but, it is interesting to note, that although after his retirement there were at Springhill something like twenty-three strikes within a period of twenty-one years, no strike took place during his term of management, which was characterized by moderation combined with firmness. In 1890, Major Leckie became general manager of the Londonderry Iron Company, a post he held for three years. At this time he was also successful in consolidating the numerous smaller coal undertakings in Cumberland County, including the Joggins Mining Company and the Milner (while the Joggins Railway was also taken in) under the title of the Canada Coal & Railway Company, now operating as the Maritime Coal Power and Railway Company. Before his departure from Nova Scotia in 1898, Major Leckie acquired the Torbrook iron mines, which he worked until they were purchased by the Messrs. Drummond, of Montreal. After leaving Torbrook, he acted in the capacity of examining engineer for Mr. Robt. M. Thompson, of New York, and in this connection reported on nickel and other mines in New Caledonia, Norway, Sweden, and Australia. He was also for many years resident consulting engineer at Sudbury to the President of the Canadian Copper Company. Since his retirement from consulting practice his activities have been employed in acquiring and partially developing promising prospects in Northern Ontario. Of these, at least one, a gold property at Long Lake, near Sudbury, has been placed on a productive basis, and having been acquired is now being sucessfully worked by the Canadian Exploration Company.

This then is the brief outline of a long and honorable professional career. It merely suggests the energy and enterprise of him who is the subject of this sketch. But Major Leckie's activities and interests were not bounded by the limitations of his profession. He was public spirited to an eminent degree. He, in co-operation with Mr. Charles Fergie and Mr. John E. Hardman, was chiefly responsible for the organization of the Mining Society of Nova Scotia. He was the first President of the Federated Canadian Mining Institute, and a charter member of the Canadian Mining Institute, which was, as is well known to members, a re-organization of the former society. He joined the American Institute of Mining Engineers in 1879, and was a Vice-President of that Society in 1893-94. He took a great interest in military affairs, and during the Fenian Raid held a commission as Lieutenant in a rifle company raised in the Eastern Townships at that time. In 1882 he was gazetted Major in the 53rd Battalion, with which regiment he remained for several years. He was an ardent Imperialist, a stalwart Conservative in politics, and a member of the Church of England. Last, but far from least, he was a sportsman to the core. Sport of every description, racing, hunting, fishing, cricket, curling, all held for him the greatest attraction, and he believed always "in playing the game." Only once in twenty years has he failed to be present at the annual meetings of the Canadian Mining Institute. Of these meetings, and more especially of "after-meetings" he was the life and soul, and despite his years ever the youngest man there. He will be sorely missed, for as one of his oldest friends has just written to the writer: "Leckie's passing over to the majority leaves the world a less happy place for all his friends; but we are sure he will be waiting for us on the other side with a smile and a hearty handclasp."

Major Leckie married in 1866, Sarah, daughter of the late John Edwards, then of Montreal. His first wife died in 1893, and he married again in 1910. Margaret Harriet, daughter of the late James Potter, of Sudbury. His surviving children by his first wife are Lieut.-Col. R. G. E. Leckie

and Captain J. E. Leckie, D.S.O., of Vancouver, B.C.; Margaret A. G., wife of B. W. D. Gillies, M.D., of Vancouver, B.C.; Marion A. N., wife of the Rev. F. Graham Orchard, of Port Hope, Ont.; Edith L. Leckie, of Vancouver, B.C.; Florence S. W., wife of A. G. M. Mainwaring, Esq., of Brockville, Ont.; and Dorothy F. W., wife of Fleet Paymaster, J. H. Annesley, R.N. By his second wife, Major Leckie leaves a little daughter, Phillys Gilmour.—H. Mortimer-Lamb.

THE LATE JAMES D. SWORD.

On January 15, news reached Victoria, B.C., of the death by drowning the previous day of Mr. James D. Sword, a well-known mining engineer. Brief information was received from the deputy mining recorder at Quathiaski cove, in the vicinity of Cape Mudge, a point within a short distance of the east coast of Vancouver Island, about halfway up its length from south to north. It is stated that Mr. Sword was proceeding in a small launch from a neighboring island to record assessment work on mining claims at the deputy recorder's office at Quathiaski cove. There was a heavy sea running and it is feared Mr. Sword when standing up in the launch lost his balance and fell overboard. Immediately on the news reaching the official at the Cove he sent out several launches and boats, but the body of the missing man was not found.

The late Mr. Sword, who was about 45 years of age, came from an old family in Staffordshire, England. After his arrival in Canada he was for some time engaged in mining enterprises in the Province of Quebec. Later, he went thence to British Columbia, and in the height of Rossland's activity in the nineties, he made that camp his headquarters, while, as the representative of the James Cooper Manufacturing Co., he sold much placer mining machinery for installation at mines in various parts of Kootenay and Boundary districts. Afterward, he was for some time in Nevada, chiefly at Tonopah and Goldfield. Returning to British Columbia he actively interested himself in new mining properties in the Coast district, for some time giving particular attention to mineral claims on the Queen Charlotte Islands, and quite recently on Valdez Island, lying between Vancouver Island and the mainland. He was of an optimistic temperament, and energetic in directing attention to the mineral resources of the newer districts of the British Columbia coast, so that his untimely death is a decided loss to the mining interest of the province. He was an early member of the Canadian Mining Institute, but some years ago, during his roving career, permitted his membership to lapse. He has left a son, about thirteen years of age, at present attending school in Vancouver, B.C.

"The Week," of Victoria, edited by Mr. Wm. Blakemore, one of the charter members of the Canadian Mining Institute, on January 17 printed the following obituary notice:

It came as a great shock to the writer of this paragraph to learn on Thursday morning that Jim Sword had been drowned in Quathiaski cove. He had no older friend in Canada, for the acquaintance dates back to the period antedating his arrival in this country. Sword was an extraordinary man in many respects. Twenty years ago he was one of the finest athletes to be met with anywhere, and probably the best boxer in Canada. This trait in his character stood for more than mere physical prowess. He was a straightforward, outspoken, care-for-nothing, hard hitter; the warmest friend a man could have, and an enemy from whom one might well wish to be delivered. He had in him a streak of the Bohemian; he could not settle long in one place. Perhaps the Kootenays claimed him longer than any other district, for he lived at Rossland and in the Boundary for upwards of ten years. Sword was essentially a free lance. The trammels of any business organization were irksome to him; he preferred a loose rein and a free foot. This spirit carried him to Colorado, Nevada and Mexico, in each of which he engaged in mining. His hobby was prospecting; he was always looking for properties, and was an excellent judge of ore. Latterly he had made his headquarters in Victoria and Seattle, and had done considerable mining business for important firms in both cities. His last enterprise was the formation of a copper company to operate on Valdez Island. He thought he had a good thing there: in his own words, "a sure winner," and had just been up to record the assessment work in order to hold the title for another year. Then fate wrote "Finis" to a strenuous and perhaps stormy career. No man was more widely known. No man was more respected for sterling qualities. Wherever one traveled in the mining districts of the West, the question was sure to crop up, "Have you see anything of Jim Sword lately?" and this wide-spread interest in his career was the best evidence that he had secured a permanent place in the thoughts of men. It is not an easy thing to appraise the value of a man's life work, but this much may well be said of Sword, that he has blazed many a mining trail, that he has been a pathfinder to ore deposits in a hundred places and that his name will forever be associated with the strong, honorable, rugged pioneers of mining in British Columbia.

CANADIAN BUILDING AT PANAMA-PACIFIC EXPOSITION.

Whatever the result of the efforts which are still being made to secure adequate representation for the Government of Great Britain, at the Panama-Pacific International Exposition, to be held in San Francisco in 1915, it is certain that the Dominion of Canada will play a most creditable part in the celebration.

The final plans for the Canadian pavilion, which is to be one of the handsomest among the buildings representative of foreign nations and states, were accepted January 21, and the process of actual construction will have begun before the publication of this article, under the supervision of Colonel William Hutchison, of Ottawa, the Canadian Exhibition Commissioner.

Colonel Hutchison arrived in San Francisco, January 14, to inaugurate the work upon the building, preparatory to the arrival of the Canadian exhibit, which is now on the way here. He was joined here by George Freeman, the London architect, who is designer of the building, and his staff.

The pavilion, which will cost approximately $300,000, will be the largest exposition building ever erected by the Canadian Government. It will be 340 ft. long, 240 ft. wide and 50 ft. high. The whole sum expended upon the building and its contents will amount to $600,000 or more.

METAL MINES AND SMELTERS IN CANADA.

The Mines Branch, Ottawa, has issued a list of the producing metal mines and the smelters of Canada. While incomplete, and issued primarily for obtaining corrections and additions to the list on file, it will be found a useful reference list.

ANNUAL MEETING AMERICAN INSTITUTE OF MINING ENGINEERS.

The Executive Committee of the New York Section has accepted an invitation from President of the Institute to arrange for the annual meeting, and it announces the following brief programme: Monday, 7 p.m.—Registration and distribution of badges. 8.15 p.m.—Address of welcome followed by smoker and collation. Ladies invited.

Tuesday, Wednesday, Thursday.—Annual meeting and technical sessions. Arrangements will be made for luncheon each day in the Engineering Societies Building.

Admission tickets required for the following evenings:

Tuesday, 8.15 p.m.—Illustrated lecture by H. W. DuBois on Placer Mining in British Columbia, at the American Museum of Natural History, 77th Street and Central Park West.

Inspection of large-scale models of the Copper Queen mine and stope, the gift of Dr. James Douglas to the Museum. These have been constructed along entirely new lines for such exhibits.

This will be followed by a collation.

All members, guests, and ladies invited.

Wednesday, 6.15 p.m.—Reception and subscription banquet at the Waldorf-Astoria.

Technical Programme.

Tuesday, Feb. 17.—10.00 a.m.—Annual Business Meeting. 10.30 a.m.—Mining and Mining Methods in the Southeast Missouri Disseminated-Lead District, by H. A. Guess; The Mill and Metallurgical Practice of the Nipissing Mining Co., Ltd, Cobalt, Ont., Canada, by James Johnston; The Disposition of Natural Resources, by George Otis Smith. 2.00 p.m.—Use of Electricity at the Penn and Republic Iron Mines, Mich., by William Kelly and F. H. Armstrong; The Application of Electric Motors to Shovels, by H. W. Rogers; Electric Traction in Mines, by Charles LeGrand; Safeguarding the Use of Electricity in Mines, by H. H. Clark; The Safety of Underground Electrical Installations, by C. M. Means; The Injection of Cement Grout into Water Bearing Fissures, by Francis Donaldson; Drilling Performances at the Kensico Dam, Catskill Aqueduct System, New York, by W. L. Saunders; The Work of Crushing, by Arthur F. Taggart.

Wednesday, Feb. 18, 10.00 a.m.

Papers on Iron and Steel.—Notes on the Plastic Deformation of Steel During Overstrain, by H. M. Howe and A. G. Levy; Notes on Some Heating and Cooling Curves of Prof. Carpenter's Electrolytic Iron, by Albert Sauveur; The Influence on Quality of Cast Iron Exerted by Oxygen, Nitrogen, and Some Other Elements, by J. E. Johnson, jr.; Research with Regard to the Non-Magnetic and Magnetic Conditions of Manganese Steel, by Prof. B. Hopkinson and Sir Robert Hadfield; Manganese Steel, with Especial Reference to the Relation of Physical Properties to Micro-Structure and Critical Ranges, by W. S. Potter; The Heat Treatment of Steel Castings, by C. D. Young, O. D. A. Pease, and C. H. Strand; Notes on an Iron-Ore Deposit near Hong Kong, China, by C. M. Weld.

Papers on Mining Law.—Why the Mining Laws Should be Revised, by Horace V. Winchell; Comparison of Mining Conditions To-day with those of 1872, in Their Relation to Federal Mineral-Land Laws, by R. W. Raymond; Objections to the Apex Law in Mining Practice, by C. F. Kelley; Should the Apex Law be Now Repealed? by Charles H. Shamel; The Apex Law in the Drumlummon Controversy, by Charles W. Goodale; The Classification of Public Lands, by George Otis Smith.

2.00 p.m.

Papers on Iron and Steel—American Steel Rail Situation, by R. W. Hunt; Manganese-Steel Rails, by Sir Robert Hadfield; Notes on Blast-Furnace Operation with a Turbo Blower, by S. G. Valentine; Data Pertaining to Gas Cleaning at the Duquesne Blast Furnaces, by A. N. Diehl; Pig Steel from Ore in the Electric Furnace, by Robert M. Keeney; Notes on the Utilization of Blast Furnace and Coke Oven Gas for Power Purpose, by Heinrich J. Freyn; Notes on Conservation of Lake Superior Iron Ores, by Charles K. Leith; The Need of Uniform Methods of Sampling Lake Superior Iron Ore, by C. B. Murray; Sound Ingots, by Sir Robert Hadfield.

Papers on Mining Law.—The Segregation and Classification of the Natural Resources of the Public Domain, by Frederick F. Sharpless; The Initiation of Title to Mineral Lands, by Albert Burch; Good Ideas in the Mining Laws of British Columbia and Mexico, by F. L. Sizer; Provisions for Judicial Review of Land Office Decisions, by M. D. Leehey; The Apex Law Illustrated by Decisions in the Cœur d'Alêne, by F. T. Greene; Uniform Mining Legislation in all States Based on Federal Acts, by C. L. Colburn; Location of Mining Claims upon Indian Reservations, by Will L. Clark; What is Mineral Land, by Grafton Mason; Mining Law Revision—How to Obtain it, by E. B. Kirby.

4.30 p.m.

Illustrated Paper on Mining of Bituminous Coal, by Samuel A. Taylor.

Thursday, Feb. 19, 10.00 a.m.

Paper on Mining Geology.—Discussion on the question (1) To what depth below the surface do the standing ground-waters extend? Opened with a paper by Alfred C. Lane. (2) To what extent is chalcocite a primary, and to what extent a secondary, mineral in ore deposits? (3) To what extent are the contact zones, often called garnet zones, produced by intrusive rocks from limestone walls, due to re-crystallization of matter original with the limestones; and to what extent are they and their associated ores due to contributions from intrusive rocks? Opened with papers by Waldemar Lindgren and C. K. Leith.

Papers on Petroleum and Gas.—The Anticlinal Theory of Oil Accumulation, by H. A. Wheeler; Scientific Installations for the Economical Burning of Liquid Fuel of any Specific Gravity, by W. N. Best; The Use of Petroleum in Dust Prevention and Road Preservation, by W. W. Page; The Killing of the Burning Gas Well in the Caddo Oil Field, La., by C. D. Keen; An Oil Land Law, by George Otis Smith.

2.00 p.m.

The Equilibrium Diagram of the System Cu_2S — Ni_3S_2, by Carle R. Hayward; Cyanidation of Silver Sulphide, by Robert Linton, Ocampo, Mex.; The Genesis of the Mercury Deposits of the Pacific Coast, by J. Allen Veatch; Ore Dressing at the Morning Mill, Mullan, Idaho, by Rush J. White; A Proposed New Converter, and the Application of the Bessemerizing Process to the Smelting of Ores, by Herbert Haas; Milling versus Hand Sorting of Lead Ore, by R. S. Handy; Nickel Deposits in the Urals, by H. W. Turner; The

Burning of Coal Beds in Place, by Alexander Bowie; The Use of Oxygen Helmets in Mine Fire, by E. P. Dudley; Geology and Ore Deposits of the Bully Hill Mining District, California, by A. C. Boyle, Jr.

Papers on Petroleum and Gas.—Cementing Oil and Gas Wells, by I. N. Knapp; The Age and Manner of Formation of Petroleum Deposits, by E. T. Dumble; Geology and Technology of the California Oil Fields, by Ralph Arnold and V. R. Garfias; Water Intrusion and Methods of Prevention in California Oil Fields, by Franklyn W. Oatman; Chlorides in Oil Field Waters, by Chester W. Washburn.

4.00 p.m.

Illustrated Address on Oil and Gas Sands, by I. N. Knapp.

PERSONAL AND GENERAL

Dr. Alfred Stansfield has completed the revision of his book on the Electric Furnace.

Mr. C. C. Hascall and Miss Margaret Sherman were married in Calumet on Jan. 31.

Mr. P. B. McDonald is at North Adams, Mass.

Mr. Robert Bryce was in Toronto last week, having completed examination of claims in MacArthur township.

Dr. F. H. Hatch, of London, president-elect of the Institution of Mining and Metallurgy, is expected in Canada shortly to make a report on mining properties at Kirkland lake, Ontario.

Col. Carson, president of the Crown Reserve Mining Co., recently visited the property at Cobalt.

Mr. W. R. P. Parker and Mr. H. P. Watson attended the meeting of the Cobalt Townsite Co. in London last month. Mr. Parker is president and Mr. Watson vice-president of the Canadian company.

Mr. G. W. Nickerson, president of the Kerr Lake Mining Company, visited the mine at Cobalt last week.

Mr. Roy H. Clarke, formerly associated with mining in Rossland camp, recently resumed practice as a mining engineer with office in Spokane, Washington, after having been for three years engaged in investigating mining properties in the southern States for the United States Smelting Co.

Mr. E. V. Buckley, manager for the Queen Mines, Incorporated, operating the Queen gold mine and 20-stamp mill in Sheep Creek camp, Nelson mining division, has returned from a trip to his home in Wisconsin.

Mr. J. M. Ruffner, manager for the North Columbia Gold Mining Co., which during recent years has operated on a larger scale than any other company working in Atlin camp, recently arrived at Vancouver from Atlin on his way to his home in Cincinnati. He was a passenger on the C. P. R. steamer "Princess Sophia," which ran on the rocks while making for shelter in Blenkinsopp bay in extremely rough weather and in a blinding snowstorm.

Mr. John A. Finch, of Spokane, who is the largest shareholder in the Standard Silver-Lead Mining Co., and who with Mr. G. H. Aylard developed the Standard mine from a prospect to its present productive condition, is spending the winter in southern California.

Mr. W. J. Elmendorf, manager of the Portland Canal Tunnels, Ltd., recently came south after having been in the Portland Canal district all the winter. He has since been visiting Tacoma and Seattle, Washington, on business matters.

Mr. Douglas Clermont Livingston, of Moscow, Idaho, has been appointed head of the mining engineering department of the University of Idaho, in succession to Mr. S. R. McCaffery, who has joined the faculty of the University of Wisconsin. Mr. Livingston was for a time with the Tyee Copper Co., of which his father, the late Mr. Clermont Livingston, of Duncans, Vancouver Island B.C., was organizer and for years general manager. After graduating from McGill in 1906, Mr. Livingston went to Mexico, where, in the capacity of superintendent for the Fortuna Mining Co. and the North Tigre Mining Co., he was engaged in opening mining properties near Yzabel, Sonora. About three years ago he was appointed associate professor of mining engineering at the University of Idaho, which position he has held until now he becomes head of the department.

Mr. Thos. L. Goldie is in Toronto.

Mr. Geo. Rogers, superintendent of the Mann mine, who has been in Toronto recently, has returned to the property at Gowganda.

The Canadian Westinghouse Co. has issued a well illustrated bulletin on mine locomotives.

Canadian Allis-Chalmers, Ltd, has issued a bulletin on iron ore washing plants.

Rock & Power Machinery, Ltd., Toronto has been awarded the contract for centrifugal pumps for pumping out Cobalt lake. The pumps to be supplied are De Laval split castings centrifugals.

The Herbert Morris company has secured from English firms two contracts, each calling for several large travelling cranes.

KIRKLAND LAKE.

Mr. H. H. Johnson, in a report on the Tough-Oakes mine, makes the following recommendations to the directors of the Kirkland Lake Proprietary, Ltd:

1. The early development of all the known veins as soon as power is available, as the exploitation of No. 2 vein at present only affects a fraction of the property.
2. The provision of an ample electric power supply to enable the necessary work to be done in the quickest and most efficient manner.
3. The erection of a reduction plant of sufficient size to act as a central plant for all of your Kirkland lake mines, and as a customs mill for neighboring mines, which would be sure to avail themselves of the manifest advantage of such a scheme.
4. The continuance of shipping high-grade ore to the smelter pending the erection of a customs smelter at Kirkland Lake.

Concerning the present equipment at the mine, Mr. Johnson says:

During the past summer a considerable number of substantial buildings have been erected on the property, including offices, assay office, drawing office, boarding house, bunk house to accommodate sixty men, store, recreation room, etc. A good water supply has been obtained from Gull lake, from whence a steam pump provides a service through a 2-in. main to the mill power plant and other buildings. The power plant consists of a 40 h.p. locomotive type boiler, supplying steam to a 25 h.p. horizontal single cylinder mill engine, a 9 k.w. direct current steam generator set for providing power for lighting and assay office motors, and a small straight-line Ingersoll air compressor. At No. 1 shaft house is a vertical boiler and single drum steam friction hoist.

The mill consists of five 1,050 lb. stamps by Allis-Chalmers, complete with good-sized ore bin with rock-breaker above. Challenge type feeder and stepped amalgam table.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Recent advices from some of the older mining districts have been distinctly satisfactory, notably from Rossland and Slocan.

Consolidated Mining and Smelting Co.

While no particulars have been made public, it is generally known at Rossland that late developments at depth in the Consolidated Mining and Smelting Co.'s Centre Star-War Eagle group of mines have been decidedly favorable, important extensions of previously known shoots of ore having been proved, and the producing capacity of the mines increased accordingly.

Standard Silver-Lead Co.

In Slocan district, the finding above No. 5 level of much more ore in the Standard Silver-Lead Mining Co.'s mine, situated in the vicinty of Silverton, Slocan lake, has proved an agreeable surprise for those who have been closely connected with that productive property during its development. The discovery referred to has led to development of a shoot of ore, not previously known to occur, that at last reports had been found to widen to about 12 ft. While less important at the present time, developments in the deeper levels of the Slocan Star mine, too, are satisfactory, for ore of high grade is being mined, so that smeltery returns leave a good margin of net profit; further, there is reason to expect early successful results from development work being done on the tenth level, which is the deepest working of this mine.

In Nelson Mining Division.

While gold is the product of mines in what is known as Sheep Creek camp, in Nelson mining division, there are lead mines within a few miles, and of these latter three have lately been shipping ore to the smeltery at Trail, namely, the Emerald, H. B. and Zincton properties, the last-mentioned being a new addition to the list of shippers.

For years the Arlington mine, in Erie camp, a few miles south of Salmo, was the most productive mine in that part of the division, although the Second Relief was an intermittent producer. Latterly the position has been changed, for the Arlington has not shipped much ore, while the Second Relief was worked during the greater part of last year. Now it is announced that a sale of the latter mine and 10-stamp mill has been made to Minneapolis men: also that it is intended to drive an adit 700 ft. to open the mine at 200 ft. greater depth, and to remodel the stamp mill so as to make it more efficient as a gold-saver.

The Yankee Girl mine, near Ymir, also in Nelson mining division, has resumed shipment of ore. For a time there was little ore in sight, but development work has improved the position, so that it is again practicable to send ore to the smeltery. In the neighboring Dundee mine, too, conditions are better, according to published statements, so that production from this property is also expected.

Progress at Britannia Mine.

Substantial progress has been made in connection with important development work undertaken at the Britannia mine in 1912 and continued throughout 1913, and with the additions to machinery, plant, transportation facilities, buildings, etc., at the mine and at and about the concentrating mill at Britannia Beach. Particulars were given some time ago of these improvements; recently some information was obtained as to progress made to date.

The intention being to provide for the main outlet from the mine being lower down the mountain side than near the upper end of the existing aerial tramway, the work of driving a crosscut adit into the mountain, to come under the older workings of the mine now being operated, at a depth 1,200 ft, below what is known as the 1,000-ft. level was undertaken in 1912. At about 4,350 ft. in from the portal of the adit driving was stopped and raising commenced in two places. One raise is an exploratory working in the mineralized zone; the other is a larger and more important undertaking, intended for use as the main working shaft of the mine. The latter is to be a three-compartment shaft, with two hoisting compartments, each 6 ft. by 7 ft. 6 in. in the clear, and a manway 3 ft. by 7 ft. 6 in. This shaft is being timbered with 12 by 12-in. Douglas fir, which is the best timber obtainable on the Coast. By the middle of February some 275 ft. had been raised. At 200 ft. up a station was cut. Later, after the shaft shall have been completed, a crushing plant, to consist of one 36 by 24-in. Blake crusher and one No. 7½ gyratory crusher, will be installed on this level, which will be 1,000 ft. below the present 1,000-ft. level of the mine and 200 ft, above the new main outlet level. Miners employed in this shaft are taken up to their working places in a cage operated by a compressed air hoist set at the foot of the raise.

It is noteworthy that this shaft or raise will be one of the longest on the American continent. The hoisting engine to be used in it after completion of the shaft is a double-drum hoist, having a capacity of 18,000 lb. vertical lift. Two cages will be run in counter-balance, and there will be 2,000 ft. of 1¼-in. rope on each drum of the hoist.

The railway for transportation of ore has been graded for about five miles, from the face of the main adit to the top of the incline above the concentrating mill. The rolling stock for use on this railway will consist of two electric 15-ton locomotives, to be driven in tandem, and a number of 20-ton cars. The incline down to the ore storage bin is 5,500 ft. long, with a difference of 1,400 ft. in elevations of terminals. It will be double-tracked all the way, and 60-lb. steel rails will be used. Two 15-ton skips will convey ore from the upper to the lower bin. The bins, at head and foot of incline, respectively, will each have a holding capacity of 1,000 tons. The engine for use in connection with the incline will be double-drum run with clutch; it will be operated by a 75-h.p. motor geared to 300, and 700-ft. speeds. Each drum of the hoisting engine will carry 6,000 ft. of 1½-in. rope.

Power supply has been increased to 3,000 h.p.—2,000 h.p. generated by water-power and 1,000 by steam. Preparations are being made for a further increase to 5,000 h.p.

New buildings include more houses for employees and, at Britannia Beach, a laundry. In addition, a superior dancing floor has been laid down, the vanner and concentrating table floor of the old concentrating building having been triple-boarded, so as to provide an unusually good floor for the company's employees for dancing purposes.

Acquirement of Forfeited Mineral Claims.

At the annual convention of the Conservative Association of British Columbia, held in Victoria on Jan.

23-24, among the many resolutions submitted by numerous local associations in various parts of the Province was one from Rossland relating to sale to the highest bidder of Crown-granted mineral claims forfeited to the Government for non-payment of taxes, and on which, after forfeiture, discovery of mineral shall have been made. Under existing regulations, the procedure is for an applicant to guarantee certain costs and then tenders are invited for purchase of such claims. This means that a man may prospect a forfeited claim and discover valuable mineral, and then have to compete with others in tendering for purchase of same. The object in view in urging a change is to provide for a prospector deriving the benefit, upon reasonable conditions, of any discovery of mineral he shall make on a claim forfeited to the Crown. As it is, there is nothing to encourage prospecting on forfeited claims, since there is no provision assuring to a prospector benefit from his work, it being open to any one to tender for purchase of a claim after it shall have been shown by the work of prospecting that mineral occurs on it. The change recommended by the Rossland resolution has for its chief object the protection of the prospector from competition and probable loss after his work shall have proved the claim to either be valuable or that there are indications of promise of favorable developments on further work being done. The last clause of the resolution, as endorsed by the convention, reads thus: "Be it resolved that the Provincial Government be urged to make such provision as would allow of such forfeited mineral claims becoming available for being acquired by prospectors and others at a cost equivalent to that of fulfilling all ordinary requirements of the Mineral Act up to and including Crown-granting, and to make provision for arranging for deferred payments, so as to make it practicable for prospectors to acquire such mining property. Such a regulation would protect prospectors from undue competition, would provide for the payment to the Government of as much as is required to be paid in either cash or work in order to obtain a Crown grant to a mineral claim in the ordinary course of procedure under the regulations relating to the Crown-granting of mineral claims, and would give the applicant for purchase the benefit of deferred payments similar to those under which other Crown lands are purchaseable ordinarily.

Portland Canal Tunnels, Ltd.

A report made by the manager of the Portland Canal Tunnels, Ltd. (Mr. W. J. Elmendorf), under date Jan. 1, has been published. It reviews the work done in connection with driving a long deep-level crosscut adit during a period of fifteen months—October, 1912, to the end of 1913. The report first mentions the object in view in driving this tunnel, with connections, "for the principal purpose of mining and handling the ores from the 'Portland Canal fissure zone.' Another important reason for driving the tunnel is the ultimate improvement and utilization of the water-power from Glacier creek."

Continuing, the report says: "Preliminary work for the tunnel was begun in September, 1912, and it consisted of clearing, road-making, and the erection of necessary buildings. The portal set of timbers was in place on Oct. 23, 1912, 42 ft. beyond the point where the ground was first broken. The progress from the portal to bedrock through the hillside gravel was necessarily slow and costly, but by Jan. 1, 1913, the face of the tunnel was 141 ft. in and the gravel left behind. From that point to the present face the bore has been in solid rock, and no timbering has been needed. On Jan. 1, 1914, the face of the tunnel was in 2,813 ft. from the portal, or 2,855 ft. from the starting point. During July and August, 1913, an adit 80 ft. in length was driven from a point 730 ft. in the tunnel, out to the Glacier Creek canyon. This supplies an excellent dumping ground and shortens the tramming and ventilating distance by 650 ft. In addition to the work in the tunnel proper and the adit, 50 ft. of drifting was done during December, 1913. The total of underground work done in 1913 was 2,844 ft. This work has been done at a cost of less than $22 per foot, including all equipment and the salary of the manager. In the case of rails, pipe, air drills and blowers, not more than 50 per cent. of the first cost should be charged off at this time. A similar proportion, at least, applies to the salary of the manager, as his services have been largely along the lines of acquiring property for the company and assisting in the general conduct of its policy and administration. With a proper allowance for these items the cost will approximate $20 a foot. When consideration is taken of the facts that $4 a day was paid to miners and muckers, and that the men were very well fed, the cost of driving the tunnel is low.

"On Dec. 22 drifting to the south on the No. 2 vein, cut by the crosscut, was commenced at a point about 2,638 ft. from the portal of the adit. By January 1 the face of this drift was in 27 ft., and the showing is described as having been 'most promising.' On Dec. 27 drifting to the north on No. 1 vein, crossed by the adit, was commenced at about 2,343 ft. from the portal, and this drift was in 21 ft. at the end of the year. The manager's comment was, 'this work will be pushed, as any round may open ore.'"

Driving the crosscut adit is now being made secondary to drifting on the two veins, just mentioned. However, its further extension will be given attention whenever practicable, for, as stated in the report, "the face of the tunnel, 175 ft. beyond No. 2 vein, looks promising for cutting another vein and, judging from the distance between the veins on the surface, another is nearly due. Three more veins, at least, are included in the 'fissure zone' and the tunnel must ultimately be driven across them."

The manager concludes as follows: "With known ore to the north and south of the tunnel and the veins encountered entirely normal, as to physical condition and position, it would seem that there should not be any question as to the nature of future operations. Drifting, preferably on both veins, should be energetically pushed until ore bodies are reached. At the same time, the tunnel should be continued across the 'fissure zone' when such work can be done without interfering with the drifts. We may still be fortunate enough to cut the veins ahead in ore and, in any event, they will be ready for later development."

COBALT, GOWGANDA AND ELK LAKE

Gowganda.—There has been a decided revival in the interest in Gowganda within the past two months and that portion of the silver field of Northern Ontario is now assured of considerable fresh capital.

It is also significant that for the first time the T. & N. O. Commission will visit Gowganda this month. Too much may be inferred from this visit; but it is certain that Mr. Englehart is more seriously considering the much urged extension of the railway from Elk Lake or he would not undertake the somewhat tedious journey. The agitation for the extension has been most persistent ever since the Elk Lake branch was put under construction.

The prospects for the mining industry are brightening. It is now definitely confirmed that the only proved mine on the West Ridge has been sold to a strong British syndicate, composed of Sir John Graham, of Glasgow, and Messrs. Hudson Bros., of Newcastle, they being represented in Canada by Mr. Claude Maitland. For the past three or four years the camp has been urgently in need of stable companies with enough money to spend in development to give the various prospects a chance. It is not likely that the purchases of the new syndicate will stop with the Mann if that property lives up to its present promise.

The Miller Lake-O'Brien, too, is doing very well. Not only is the ore on the lower or 350 ft. level as good as on upper workings, but much new ground is being broken, with excellent results. Good progress is being made with the hydro-electric plant. So excellent appear the prospects of the new find on the Millerett that a permanent head frame is being erected above the shaft near the old office. Sinking will commence at once. The vein is one of the system uncovered last summer. To date the shaft has been sunk 20 ft., the vein is 2 in. wide of 2,000 oz. ore. The shaft will be taken down to the 100 ft. level. To date a good quantity of high grade ore has been taken out of the shaft and treated in the sorting plant on the Miller Lake O'Brien.

On the Miller Lake O'Brien itself a surface discovery made about a month ago is developing well. It is on the surface about two in. wide of high grade and has now been uncovered for 200 ft.

A little high grade ore has also been found at the 40 ft. level of the Walsh mines on Miller lake.

Coniagas.—The strike at the Coniagas mine was very short lived. Claiming that the Coniagas mine had made no difference in their working hours and was therefore evading the eight-hour-day law, the local branch of the Western Federation of Miners called a strike. About seventy-five men walked out. Their places were filled in a few days and as many of the men as could get back, went back. Very little attempt was made on the part of the local union to support the strike.

Hudson Bay.—The production of the Hudson Bay mine for the last month of 1913 was 49,721 oz. During the month 1,945 tons were crushed in the mill. The average assays of heads was 23.6 oz., while the tailings ran 2.8 oz. The average extraction was 88.7 per cent. 74.8 tons daily were treated at the mill. A production of slightly less than 50,000 oz. was made, the greater part coming from mill ore.

Crown Reserve.—High grade has been opened up for 30 ft. in a branch stringer from the Fleming vein on the 150 ft. level of the Crown Reserve mine. The ore runs between 3,000 and 4,000 oz. to the ton. The Fleming vein itself has been cut in a crosscut from the Crown Reserve; but results have not been promising for the future. For the 150 ft. driven, most of the ore is low grade, with an occasional patch of high grade.

In the annual report just published, Mr. S. W. Cohen, general manager of the Crown Reserve places the probable ore reserves at 3,000,000 oz. He explains the sudden drop in ore reserves as follows: "In the last annual report it was stated that 25 per cent. of the 100 ft. stope on the Carson vein was left, which, figuring that 25 per cent. of the values would also be contained, meant 1,500,000 oz. Only 200,000 oz. was mined from the vein during the year, with no material amount to be further expected, and this falling off caused a decrease in the company's earnings. Mr. Cohen adds that the mine is still a good mine, with known ore reserves, even if its earning capacity could no longer be considered as phenomenal. The production for the past year showed a decrease of approximately 1,000,000 oz., being 1,776,678 oz., against 2,714,766 oz. in 1912. Of this amount 523,382 oz. was produced from mill ore and remainder from high grade. The cost per oz. rose to 23 cents, as compared with 14.027 cents an oz. last year.

Compressors for Gowganda.—A three-drill compressor and accessories have been purchased by the Hewitt Lake mining syndicate of Gowganda, and have been shipped. The Miller Lake O'Brien, in the same camp, has also ordered a twelve drill compressor.

Bailey.—What is supposed to be the old discovery on No. 1 vein of the Bailey has been found on the fifth level of the mine, and drifting operations have revealed a strong vein with some values. The fifth level, at a depth of 280 ft., was opened since the first of the year, and from this depth it is contemplated much exploration work will be done. The annual meeting was held in Chicago at the end of January, but so far nothing has been made public. At this meeting it was to be decided whether the interests in control would realize on what they had in sight, or embark on a further development of the mine. Development this year has been unsatisfactory. On the Penn Canadian, the adjoining property, the Big Pete vein has been picked up again, giving promise of a considerable extension of this important ore body.

Wettlaufer.—The annual report of the Wettlaufer mine shows that the only present producer of the South Lorrain camp is without ore reserves or future profits, and has been shut down accordingly. The profit shown is only $38,042, against $320,248 the previous year. The production was 252,864 oz., while reserves amount to only 3,000 oz. left in one pillar underground. There has been paid in dividends since 1913 $141,659, and there is cash on hand and quick assets $141,920. The shipments for the past year amounted to 147,425 oz. of first-class, 11,417 oz. of second class, and 72,965 of concentrates and 17,182 oz. of bullion.

Mr. Robert Livermore, the manager, summarizes this most mournful report with "development at depth was most disappointing."

The only hope of South Lorrain is now the old Keeley, which under Hamilton-Ehrlich management proved quite promising the latter part of 1913, but was closed down until the winter was over.

PORCUPINE AND KIRKLAND LAKE

Hollinger.—The annual report of the Hollinger mine was, from an engineering point of view, generally regarded as excellent, though speculators were inclined to hope for more declared ore in the reserves and an implied increase of dividend. Mr. Robbins continues to adopt the practice of estimating ore blocked out and superadding ore which he regards as probable. Ore actually blocked out amounted, after a production of $3,500,000 had been made to over $11,000,000 and ore blocked out and "possible" ore to $17,000,000. Just as the report was compiled two new veins were cut with the diamond drill from the 425 ft. level.

Merger of Pearl Lake Properties.—While the proposed merger on Pearl Lake is not likely to be as comprehensive as first planned, it is quite probable that some consolidation will preface resumption of activity among some of the prospects. The properties mentioned at first in the proposed merger were the Plenaurum, Jupiter, Pearl Lake, McIntyre, Schumacher, and two properties of the McMartin-Dunlap syndicate. It is now certain that the Schumacher will not be included, since Mr. Schumacher has applied for a charter, and will

capitalize at $2,000,000. Of the others it is possible that the McIntyre and the Pearl Lake may be worked jointly, and the Plenaurum and the Jupiter. The Vipond is likely to be developed without co-operation from other mines.

Dome.—The Dome mill is now treating from 450 to 500 tons of ore per day. One day the total of 550 tons was reached. The installation of the extra 40 stamps has made such good progress that it is most probable that all the eighty stamps will be dropping in March or early in April. The Dome has ordered a 25 drill compressor to augment its present power plant.

McArthur Township.—The Cobalt syndicate, for whom Mr. Robert Bryce was acting, has thrown up its option on the St. Paul claims in McArthur township. The claims were very thoroughly sampled, and it was at one time hoped that another large low grade ore body had been discovered. But a mill run of three tons proved disappointing.

Tough-Oakes.—Much interest was experienced in the first annual report of the Tough-Oakes gold mines since it is the mine which this company owns that is the main possession of the Kirkland Lake Proprietary. Mr. Chas. O'Connell in a summary of his report of physical conditions, states that in the first year of development the ore extracted has a value in excess of the actual cost of all development work. The net results from the ore and bullion shipments, ore on the dumps and contents of the mill tailings was nearly equal to the total amount expended on the property. The gross value of the ore blocked out on three sides is over $750.000.

As to ore reserves, it is stated that on both sides of the main vein the conglomerate as well as the porphyry contains numerous stringers and veinlets of quartz, all of which contain gold. Several hundred samples have been taken in the foot-wall section throughout the workings. From the results of these samples, as well as the milling record of 1915 tons, the average value of the milling ore exposed to date is taken at $23.30 per ton. There has been only a small amount of exploration in the hanging wall section to date; but from the information it is expected that about three feet can be stoped on each side of the main vein with excellent results.

Work has been commenced on No. 3 vein. It is 400 ft. north of and parallel with the main vein, and has been stripped for 510 ft. It will average 17 in. in width. The results of close sampling indicate that it will average high grade for at least 350 ft. A shaft has been started at a point 160 ft. from the west end and levels will be driven at 100 and 200 ft. At the 200 or second level a crosscut will be driven south to connect with the main vein.

Before Mr. C. A. Foster returned to England he had acquired the Burnside claim, presumably for the Kirkland Lake Proprietary, and had options on the control of the Teck Hughes, the Sylvanite and other Kirkland lake properties.

McIntyre.—The McIntyre is working at the 400 and 600 ft. levels from the Pearl lake shaft owing to an arrangement with the latter company. On the 600 ft. level a new vein has been cut. The first cut samples averaged $8.40. This is the second ore body encountered during the month of January on the McIntyre.

Porcupine Crown.—The annual report of the Porcupine Crown shows that there has been blocked out 86,000 tons of ore valued at $1,923,806. The average value of the ore is $22.37 per ton. The total cost per ton, based on the period when the mine was running at full efficiency, was $7.79, leaving a profit of $14.58 a ton. In his summary of operations Mr. S. W. Cohen, general manager, states that at the present rate of production 35,000 tons will be handled during the coming year or almost twice as much as during the past year. There should be no difficulty in earning a net profit of $300,000, Mr. Cohen thinks. The report states that in the winze below the 400 ft. level the ore ran $70 over 5 ft., but that the vein had not been picked up yet in the level. The mill treating 100 tons per day is making an extraction of 96 per cent. at an average cost of $1.50 per ton.

Porphyry Hill.—A thirty-six ton car of gold ore has been shipped from the old Preston East Dome claims, now worked by the original owners. The car contained about $175 a ton ore. The Preston East Dome is now known as the Porphyry Hill.

Schumacher.—Mr. F. W. Schumacher has decided to capitalize his holdings in Porcupine and make a public offering of stock. One ore shoot on one vein has been opened up for 125 ft. on the 100 ft. level. It is of good grade ore and of good width. Another shoot of ore on the same vein is from 30 to 40 ft. long. Only two drills are at work at present on the property.

Hollinger Reserve.—It is understood that the General Development Co. has made its big payment on the Hollinger Reserve and that it has now been practically decided to take up that Ogden property. The property is being developed at the 200 and 300 ft. levels and results are understood to be satisfactory. There are between 50 and 60 men at work.

A sharp drop in the market value of Nipissing is accompanied by rumors of decrease in earnings and consequent probability of reduction in distributions to shareholders.

London papers comment unfavorably on the recent flotation of Kirkland Lake Proprietary, Ltd.

It is reported that the Mann mine at Gowganda has been sold to English interests represented by Mr. Claude Maitland.

The third annual meeting of Hollinger Gold Mines, Ltd., was held in Montreal on Monday, Feb. 2, 1914.

The improved condition of the Rossland properties of the Consolidated Mining and Smelting Company of Canada is arousing interest in that company's operations.

COBALT ORE AND BULLION SHIPMENTS.

The ore shipments for the week ending Feb. 6 were:

	Pounds.
Cobalt-Aladdin	103,000
Crown Reserve	45,990
Coniagas	140,130
Dominion Reduction	85,150
McKinley Darragh	64,390
Seneca-Superior	64,680
Trethewey	87,570
Beaver	58,790
Timiskaming	73,690
Total	733,390

The bullion shipments for the week ending Feb. 6, are:

Mines.	Bars.	Ounces.	Value.
Nipissing	55	43,192.55	$24,835
Kerr	11	7,848.00	4,565
Casey Cobalt	4	4,893.00	1,484
O'Brien	17	16,044.30	9,225
Buffalo	68	70,511.00	41,000
Totals	155	140,488.85	$81,110

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

February 9, 1914.

New York Curb.

	Bid.	Ask.
Alaska Gold	22.62	23.00
British Copper	3.50	3.75
Braden Copper	7.50	7.75
California Oil	306.00	310.00
Chino Copper	43.25	43.50
Giroux Copper	1.00	1.50
Green Can.	40.00	42.00
Granby	85.00	94.00
Miami Copper	23.00	23.37
Nevada Copper	16.25	16.50
Ohio Oil	159.00	161.00
Ray Cons. Copper	20.00	20.25
Standard Oil of N. Y.	187.00	189.00
Standard Oil of N. J.	422.00	424.00
Tonopah Belmont	7.87	8.12
Tonopah Merger	.65	.67
Inspiration Copper	17.25	17.75
Goldfield Cons.	11.50	11.62
Yukon Gold	2.37	2.62

Porcupine Stocks.

	Bid.	Ask.
Apex	.01	.02
Dome Extension	.07¾	.08
Dome Lake	.27	.27½
Dome Mines	16.50	18.00
Foley O'Brien	.17	.18
Hollinger	16.50	16.75
Jupiter	.08½	.08¾
McIntyre	1.33	1.36
Moneta	.01	.04
North Dome	...	.40
Northern Exploration	2.85	3.00
Pearl Lake	.07¼	.07½
Plenaurum	...	.60
Porcupine Gold	.11¼	.11½
Imperial	.01¾	.02
Preston East Dome	.01	.01¼
Rea	.15	.25
Standard	...	.01
Swastika	.03	.04
West Dome	.05	.07
Porcupine Crown	1.23	1.25
Teck Hughes	.20	.30

Cobalt Stocks.

	Bid.	Ask.
Bailey	.04¼	.04½
Beaver	.25½	.26
Buffalo	1.75	2.00
Canadian	...	.10
Chambers Ferland	.17½	.18
City of Cobalt	.30	.35
Cobalt Lake	.60	.70
Coniagas	7.50	7.75
Crown Reserve	1.79	1.82
Foster	.05	.08
Gifford	.03	.04
Gould	.02½	.02⅝
Great Northern	.09½	.09¾
Hargraves	.02	.02½
Hudson Bay	71.00	76.00
Kerr Lake	4.65	4.85
La Rose	1.63	1.66
McKinley	1.18	1.24
Nipissing	6.30	6.40
Peterson Lake	.27	.27½
Right of Way	.04	.05
Rochester	.02½	.02¾
Leaf	.01	.02
Cochrane	...	.40
Silver Queen	.05	.08
Timiskaming	.13½	.14
Trethewey	.22	.25
Wettlaufer	.05	.08
Seneca Superior	2.70	3.00

TORONTO MARKETS.

Feb. 11.—(Quotations from Canada Metal Co., Toronto):
- Spelter, 5¼ cents per lb.
- Lead, 5½ cents per lb.
- Tin, 42 cents per lb.
- Antimony, 8½ cents per lb.
- Copper, casting, 15½ cents per lb.
- Electrolytic, 15 cents per lb.
- Ingot brass, 10 to 15 cents per lb.

Feb. 10.—Pig Iron—(Quotations from Drummond, McCall & Co., Toronto):
- Summerlee No. 1, $26.00 (f.o.b. Toronto).
- Summerlee No. 2, $25.00 (f.o.b. Toronto).

Feb. 10.—Coal—(Quotations from Elias Rogers Co., Toronto):
- Anthracite, $8.25 per ton.
- Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

Feb. 9.—Connellsville coke (f.o.b. ovens):
- Furnace coke, prompt, $1.90 per ton.
- Foundry coke, prompt, $2.40 to $2.65 per ton.

Feb. 9.—Tin, straits, 40.45 cents.
- Copper, Prime Lake, 14.87½ to 15.12½ cents.
- Electrolytic copper, 14.65 to 14.75 cents.
- Copper wire, 15.87½ to 16.00 cents.
- Lead, 4.15 to 4.20 cents.
- Spelter, 5.45 to 5.50 cents.
- Sheet zinc (f.o.b. smelter), 7.25 cents.
- Sheet zinc (f.o.b. smelter, 7.25 cents.
- Antimony, Cookson's, 7.25 cents.
- Aluminum, 18.75 to 19.00 cents.
- Nickel, 40.00 to 45.00 cents.
- Platinum, hard, 10%, $46.00 to $47.50 per ounce.
- Platinum, hard, 20%, $49.00 to $51.50 per ounce.
- Platinum, soft, $43.00 to $44.00 per ounce.
- Bismuth, $1.95 to $2.15 per pound.
- Quicksilver, $38.00 per 75-pound flask.

SILVER PRICES.

	New York cents.	London pence.
Jan. 29	57½	26 8/16
" 30	57¼	26 7/16
" 31	57¼	26 7/16
Feb. 2	57¾	26 11/16
" 3	57⅝	26⅝
" 4	57⅜	26½
" 5	57⅜	26½
" 6	57½	26 8/16
" 7	57⅝	26⅝
" 9	57¾	26 11/16

"Tested Packings for Every Purpose"

This pamphlet is an authentic text-book---a complete illustrated guide---to standard lines of tested packings.

We shall be glad to send you a copy, gratis.

Canadian Consolidated Rubber Company, Limited

MONTREAL

Please use this Coupon ☞

Canadian Consolidated Rubber Co., Ltd., Montreal.

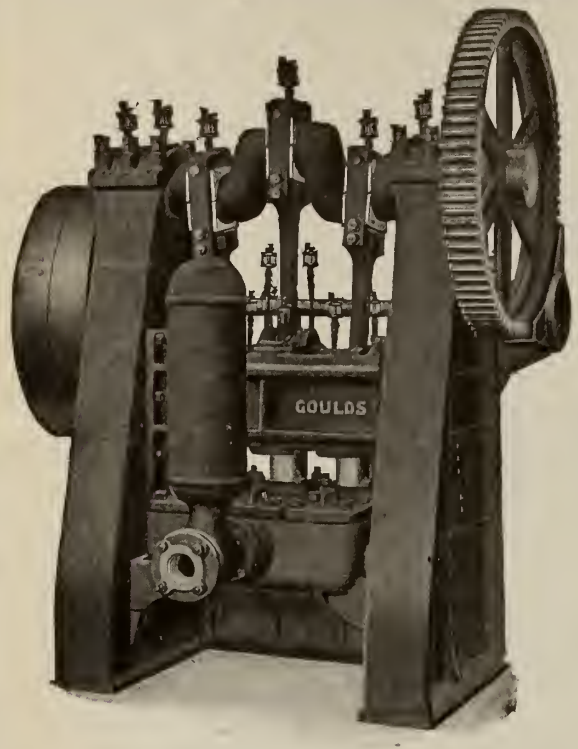
Gentlemen :

Please send me a complimentary copy of "Tested Packings for Every Purpose."

Name.....

Address.....

C.M.J.



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam Shovels**: Specially Flexible Ropes for **Winches** and **Fast Hoists**, **Coal Towers** and **Cranes**.

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:—

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Scott, O. N.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & Deyell
Heys, Thos. & Son.
Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd
Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place
New York City

DEPENCIER, H. P.
Consulting Mining Engineer
Room 613, Dominion Express Bldg.,
MONTREAL.
Phone Main 4984 P. O. Box 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
Belleville, Ontario.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

What is your specialty ?
What is your address ?
Our readers want to know.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

O. N. SCOTT, B. Sc.
MINING ENGINEER
DOMINION BOND BUILDING
(Cor. King and Yonge Sts.) TORONTO
Tel. Main 1585 Cable Address "Onscott"

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

MAURICE W. SUMMERHAYES
Mining Engineer,
McENANEY MINES
Schumacher P.O., - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

CANADIAN MINING INSTITUTE

REMOVAL OF HEADQUARTERS

Notice is hereby given that on February 1st, 1914, the Secretary's Office and Library of the Institute has been established at

Rooms 911 and 912, RITZ-CARLTON HOTEL,
Sherbrooke Street West, MONTREAL.

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

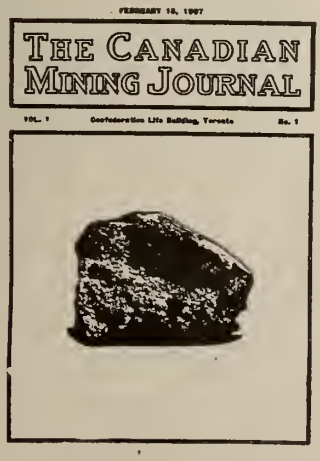
ANNUAL REPORTS
Mining Company Reports should be very carefully printed. We can give you satisfaction.
INDUSTRIAL & TECHNICAL PRESS, LIMITED
44-46 Lombard Street, Toronto

Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

Experienced Mining Cost Clerk, Bookkeeper and Office Manager, seeks situation. Speaks fluent Spanish in addition to English.
Apply Box H, Canadian Mining Journal.



The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

1085. Descriptive Sketch of the Geology and Economic Minerals of Canada. Accompanied by a geological and mineral map of Canada, by G. A. Young and R. W. Brock.
Guide Books to excursions of the International Geological Congress.
1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1165. Memoir No. 18. Bathurst District, New Brunswick, by G. A. Young. Maps not yet published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1220. Memoir 29. Oil and gas prospects of the Northwest Provinces of Canada, by Wyatt Malcolm.

BRITISH COLUMBIA

1206. Memoir No. 26. Geology and Mineral Resources of the Tulameen District, B.C., by Charles Camsell.
1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1042. Mineral Map of Canada. Scale 100 miles to 1 inch.
1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1208. Map 53A. Southeast Nova Scotia. Scale 4 miles to 1 inch.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
1300. Map 100A. Bell River, Quebec. Geology.

ONTARIO

1177. Map 31A. Larder Lake, Nipissing District, Ontario. Geology.
1244. Map 64A. Advance geological copy of map of Gowganda Mining Division and vicinity.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.
1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.
1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.
1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1195. Map 45A. Tulameen, Yale District, British Columbia. Topography.
1196. Map 46A. Tulameen, Yale District, British Columbia. Geology.
1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.
1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.
1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.
1304. Map 106A. Groundhog coal field, British Columbia. Geology.
1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

YUKON and NORTH WEST TERRITORIES

1089. Map 9A. Explored routes on parts of the Albany, Severn and Winisk Rivers. Scale 8 miles to 1 inch.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

WATERWORKS PUMPS

High Duty Horizontal Compound and Vertical Triple Expansion

PUMPING ENGINES

Capacities from One-Half Million to Thirty Million Gallons per twenty-four hours

Specifications on Request

The John Inglis Co., LIMITED

Boilermakers and Engineers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in

Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF . . . . . **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office : 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE

WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of

Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

Back or Current Numbers

of any American or Foreign technical or trade Journal furnished on short notice at moderate rates; also newspapers and magazines. Government and State Reports of all kinds in stock. Clippings on special subjects furnished promptly. Magazines and papers of all kinds bought.

Special subscription price list on request.

A. W. Castellanos
263 Armstrong Avenue
Jersey City, N.J., U.S.A.

Sprague Flexible Steel Armoured Hose

— for —

Compressed Air or Steam

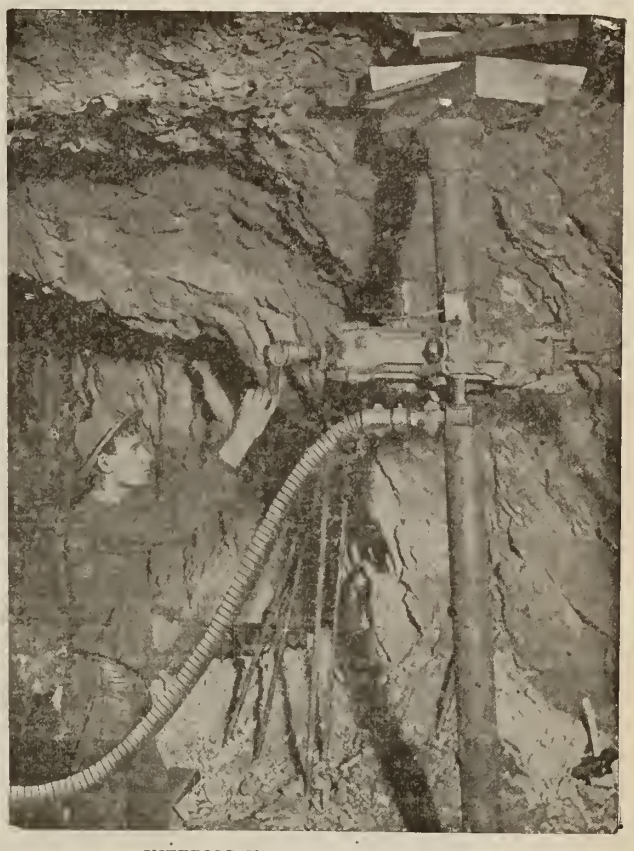
Rough wearing places are met with in mines, tunnels and shafts, and Flexible Steel Armoured Hose meets these conditions precisely.

The rubber within the armour of this hose merely acts as a conveyance for air, while the pressure is retained by the *interlocking galvanized armour*, and not alone by the hose proper.

See Bulletin 516

Canadian General Electric Co.
Limited

Head Office : **Toronto**



INTERIOR VIEW OF COPPER MINE

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $10 an acre for SUPERIOR METALS when more than 20 miles distant from a railway and $20 an acre when less than 20 miles.

For INFERIOR METALS the prices are $2.00 and $4.00 an acre respectively.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co..... 22
Amatite Roofing 13
American Diamond Rock Drill Co. 16
Astley, J. W..... 23

B

Bartlett, C. O., & Snow Co..... 17
Bath, Henry & Son..... 28
Beatty, M. & Sons, Ltd..... 11
Belleville Assay Office 25
Bennet, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons..... 16
Blackwell, Geo. G., Sons & Co.... 28
British Columbia, Province of.... 18
Brown & Butters 23
A. M. Byers Co.....Inside Front Cover

C

Canadian General Electric Co., Ltd 29
Campbell & Deyell 25
Canadian Bag Co..... 13
Canadian Bank of Commerce..... 8
Canadian Cleveland Drill Co..... 9
Can. Consolidated Rubber Co., Ltd. 21
Canadian Copper Co..... 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Laboratories, Ltd..... 25
Canadian Northern Steamships ... 7
Canadian Ingersoll-Rand Co., Ltd. 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Capell Fan Co..... 16
Carter & Smith..... 23
Castellanos, A. W. 28
Cohen, S. W..... 23
Colvocoresses, G. M..... 23
Consolidated Mining & Smelting Co. 28
Coniagas Reduction Co., Ltd..... 28
Curtis's & Harvey.....
.....Outside back cover

D

Dept. of Mines, Canada..... 26
Deloro Mining & Reduction Co.... 28
DePencier, H. P..... 23
Diamond Drill Contracting Co.... 16
Dominion Coal Co., Ltd..... 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co..... 16
Donald, Dr. J. T..... 25
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W..... 23

F

Ferrier, W. F..... 23
Fleck, Alex. 7
Flory, S., Mfg. Co..... 12
Forbes, D. L. H..... 23
Fowler, S. S..... 23
Fraser & Chalmers, Ltd..... 4
Federal Engineering Co., Ltd. ... 31

G

Graham, S. N..... 23
Gray, John. 25
Greening, B., Wire Co., Ltd..... 10
Gwillim, J. C..... 23

H

Hadfield's Steel Foundry Co. 6
Handley, John. 24
Hardman, J. E..... 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd..... 25
Heys, Thos. & Son..... 25
Hille, F. 24
Holman Drill Co..... 20

I

Inglis, John & Co., Ltd..... 27
Imperial Bank of Canada 2
Industrial & Technical Press 14
International Nickel Co. 8
International Engineering Works Ltd. 11

J

James Ore Concentrator Co.....
.....Outside back cover
Johnson, W. S..... 24
Jones & Glassco..... 19
H. W. Johns-Manville Co., Ltd... 9

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co..... 25
Loring, F. C..... 24
Lymans, Limited. 9
Lands of the Algoma Central and Hudson Bay Ry..... 36

M

Morton, B. K. & Co..... 18
McEvoy, James 24
Mussens, Limited. . . ..
.....20 and front cover
Michigan College of Mines 7
Herbert Morris Crane & Hoist Co. 16

N

Nova Scotia Steel & Coal Co..... 10
Nova Scotia, Province of..... 15
Northern Canada Supply Co., Ltd. 7
Northern Electric & Mfg. Co., Ltd. 5

O

Orenstein-Arthur Koppel Co..... 5
Oxford Copper Co. 8
Ontario, Province of 30

P

Paterson Mfg. Co..... 13
Peacock Bros. 6
Pickings, H. B. 24
Pyke, Jas. W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd..... 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Scott, O. N. 24
Segsworth, W. E..... 24
Siemens Co. of Canada, Ltd. 35
Smart-Turner Machine Co..... 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co 25
Smith, Thos. & Wm., Ltd.....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Sullivan Machinery Co..... 2
Summerhayes, Maurice W..... 24
Swedish Steel & Importing Co., Ltd. 12
Standard Underground Cable Co. of Canada, Ltd. 15

T

Toronto University 2
Tyrrell, J. B..... 24

W

Willmott, A. B..... 24
Walker Bros. 6

TRADE MARK LANCO BALATA BELTING

This is the Belt to stand the cold. Will not crack.

Federal Engineering Co.
LIMITED
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

THE ROESSLER & HASSLACHER CHEMICAL COMPANY CHEMISTS NEW YORK NIAGARA FALLS

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt, Ont.
Ledoux & Co., 99 John St., New York.
Thos. Hayes & Son, 124 onge St., Toronto.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Bags—
Canadian Bag Co., Ltd.
Smart-Woods, Ltd.

Ball Mills—
Canadian Alis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Mussens, Limited.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried.A. G., Germany.
Mussens, Limited.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Limited.
Northern Canada Supply Co.
Jones & Glassco.
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineers Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd.
Thomas & William Smith.
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada), Limited.
Mussens, Limited.
Northern Canada Supply Co.

Blowers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried.A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.

Boilers
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
Canadian Ingersoll-Rand Co., Ltd.
The John Inglis Co., Ltd.

Buckets—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Limited.
Northern Canada Supply Co.

Buildings—Steel Frame
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd.

Cable — Aerial and Underground—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Limited.
Mussens, Limited.

Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Limited.
Northern Canada Supply Co.

Cables—Wire—
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.

Carriers—
The Herbert Morris Crane & Hoist Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co

Case Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Cement Machinery—
Canadian Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.

Chains—
Jeffrey Mfg. Co.
Peacock Brothers.
Jones & Glassco.
Mussens, Limited.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.

Chain, Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell.
Thos. Heys & Son.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Limited.

Coal Handling Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.). Ltd

Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Canadian Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Limited.
Peacock Brothers.

Compressors—Air—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd.
Laurie & Lamb.
Canadian Westinghouse.
Can. Ingersoll-Rand Co., Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Canadian Allis-Chalmers, Ltd.
Peacocks Brothers.
Mussens, Limited.
Northern Canada Supply Co.

Condensers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Brothers.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Brothers.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Waterous Engine Works.
Canadian Fairbanks-Morse. Co., Ltd.

Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
SmartTurner Machine Co.
Peacock Brothers.
Mussens, Limited.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany.

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Gantry—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Hand Power—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Lymans, Limited.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Hadfields Steel Foundry Co.

Cyanide Plants—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Roessler & Hasslacher.
Mussens, Limited.
Thomas & William Smith.
Peacock Brothers.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Limited.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons.
Mussens, Limited.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Brothers.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Standard Diamond Drill Co.

Drills—Diamond.
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Canadian Ingersoll-Rand Co.
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Siemens Co. of Can., Ltd.
Canadian Ingersoll-Rand Co.

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Limited.
Orenstein-Arthur Koppel Co.

Dynamite—
Curtis & Harvey (Canada), Limited.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Limited.
Peacock Brothers.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Elevators—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Peacock Brothers.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Brothers.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Brothers.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Mussens, Limited.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Brothers.
M. Beatty & Sons.
Canadian Westinghouse.
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Brothers.
The John Englis Co., Ltd.
Can. Fairbanks-Morse Co.

Engines—Oil—
Peacock Brothers.
Can. Fairbanks-Morse Co.

Engines—Steam—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Mahine Co.
Robb Engineering Co.
S. Flory Mfg. Co.
Alex. Fleck.
Peacock Bros.
M. Beatty & Sons.
Laurie & Lamb.
Mussens, Limited.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Brothers.
Mussens, Limited.

Feeders—Ore—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Mussens, Limited.

Filters—
Krupp, Fried, A. G., Germany.

Friction Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co. Ltd.

Forgings—
M. Beatty & Sons.
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Brothers.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA : - - - - - - Halifax
QUEBEC : - - - - - - Montreal
ONTARIO : Toronto, Cobalt, South Porcupine, Port Arthur, Kingston
MANITOBA : - - - - - - Winnipeg
ALBERTA : - - - - - - - - Edmonton
BRITISH COLUMBIA : Vancouver, Victoria, Nelson, Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krupp, Fried, A. G., Germany.
Lymans, Limited.
Mussens, Limited.

Fuse—
Peacock Brothers.
Curtis & Harvey, (Canada). Limited.
Canadian Westinghouse.
Canadian Explosives.
Mussens, Limited.
Northern Canada Supply Co.

Gears—
Canadian Westinghouse.
Krupp, Fried, A. G., Germany.
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada., Ltd.

Girders—Steel—
Dominion Bridge Co.

Gravity Lowering Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Hangers—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Heaters—Feed Water—
Mussens, Limited.
Laurie & Lamb.
Canadian Westinghouse.
Peacock Brothers.
Fraser & Chalmers, Ltd.

High Speed Steel Twist Drills—
Mussens, Limited.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co. Ltd
Peacock Brothers.
Krupp, Fried, A. G., Germany.
Mussens Limited.
Canadian Allis-Chalmers, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
Waterous Engine Works.
M. Beatty & Sons.
Can. Fairbanks-Morse Co.
Fraser & Chalmers Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Canadian Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Limited.
Waterous Engine Works.

Hose—
Can. Genl Electric Co., Ltd.
H. W. Johns-Manville Co.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Can. Cleveland Drill Co.
Northern Canada Supply Co.

Jacks—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Canadian Allis-Chalmers, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Limited.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives.
Peacock Brothers.
Ackroyd & Best.
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works.
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—electric—
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Siemens Co. of Can., Ltd.

Locomotives—Steam—
Mussens, Limited.
Canadian Westinghouse.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Ore Sacks—
Can. Bag Co.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining & Smelting Co. of Canada.
Krupp, Fried, A. G., Germany.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Limited.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Peacock Brothers.

Pipes—
Consolidated Mining & Smelting Co.
Peacock Brothers.
Laurie & Lamb.
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Westinghouse.
Northern Canada Supply Co.

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Brothers.
Jones & Glassco.

Producer—Gas—
Krupp, Fried. A.G., Germany.
Mussens, Limited.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
Smart-Turner Machine Co.
Krupp, Fried. A.G., Germany.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.
Laurie & Lamb.
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Canadian Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Alex. Fleck.
Mussens, Limited.
Smart-Turner Machine Co.
Peacock Brothers.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumotic—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Smart-Turner Machine Co.
Canadian Ingersoll-Rrand Co.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Can. Ingersoll-Rand Co.

Pumps—Steam—
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
Alex. Fleck.
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A.G., Germany.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany.

Rolls—Crushing—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Fraser & Chalmers, Ltd.
Canadian Allis-Chalmers, Ltd

Roofing—
Patterson Mfg. Co.
Dominion Bridge Co.
Mussens, Limited.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories.
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A.G., Germany.
Thos. Hays & Sons.

Screens—
Mussens, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Self Landing, Self Delivery Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Smart-Turner Machine Co.
Peacock Brothers.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany.

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Mussens, Limited.
M. Beatty & Sons.

Slime Tables—
Diester Concentrator Co.
James Ore Concentrator.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Smelting Machinery—
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Can. Allis-Chalmers.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drill—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A. G., Germany.
Canadian Ingersoll-Rand Co. Ltd.
Peacock Brothers.
Swedish Steel & Imp. Co, Ltd

Steel—Tool—
Mussens, Limited.
Thos. & Wm. Smith.
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co, Ltd

Surveying Instruments—
Peacock Brothers.
W. F. Stanley.
C. L. Berger.

Switchboards—
Canadian Westinghouse.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Limited.
Krupp, Fried. A. G., Germany,
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Limited.
B. Greening Wire Co.
Can. Allis-Chalmers Ltd

Transformers—
Canadian Westinghouse.
Can. Fairbanks-Morse Co.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Transits—
C. L. Berger & Sons.
W. F. Stanley.
Peacock Brothers.

Tractors—Oil—
Canadian Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Limited.
Krupp, Fried. A. G., Germany,
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse.
Peacock Brothers.
Laurie & Lamb.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.
Krupp, Fried. A. G., Germany,
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Winding Engines—
Waterous Engine Works.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Can. Ingersoll-Rand Co., Ltd.
Fraser Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Wire Cloth—
Can. Allis-Chalmers, Ltd.
Mussens, Limited.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Standard Underground Cable Co. of Canada. Ltd.

Wire—Magnet—
Standard Underground Cable Co. of Canada. Ltd.

Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

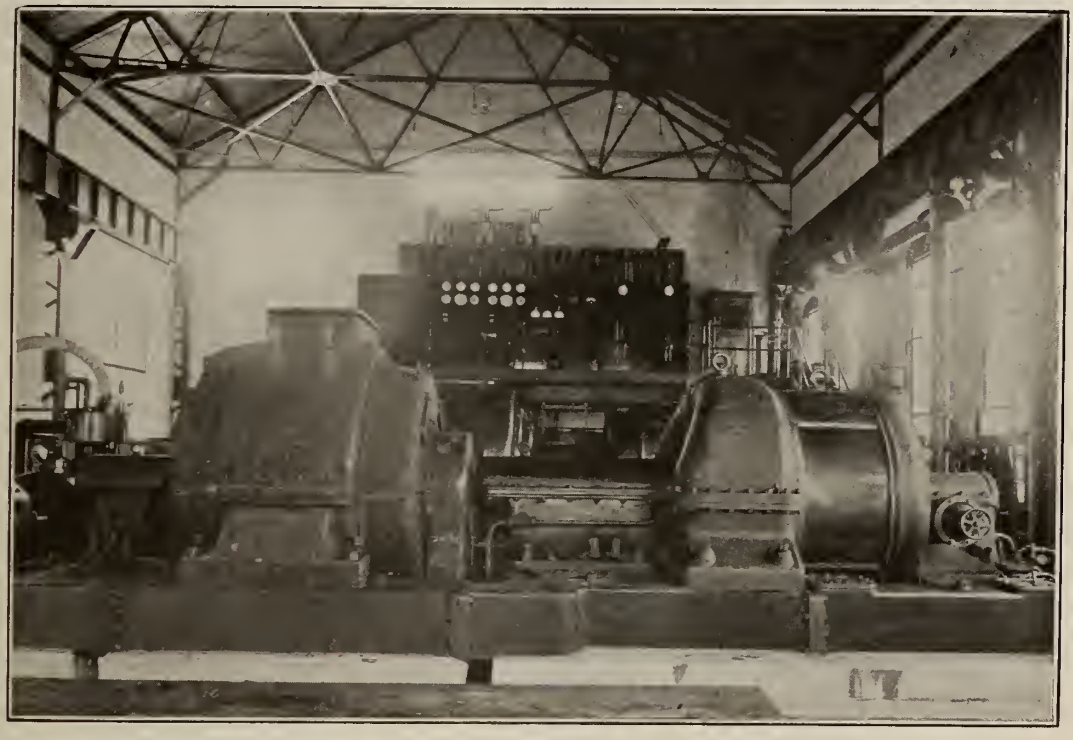
Zinc Dust—
Roessler & Hasslacher.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS

SIEMENS—SCHUCKERT | SIEMENS & HALSKE



Siemens 2,500 K.W., 25 cycle, 6,600 Volt Turbo Generator with Switchboard, supplied to the Dominion Coal Company, Nova Scotia.

The following Siemens **Turbo Generators** have been supplied or are on order for Canada.

1—4000 K.W. Edmonton.
1—3000 K.W. Regina.
1—2500 K.W. Dominion Coal Co.
1—2000 K.W. Dawson City
1—2000 K.W. Dawson City.
1—2000 K.W. Dawson City.
1—2000 K.W. Edmonton.
1—1500 K.W. Regina.
1—1500 K.W. Regina.
1—1500 K.W. Moose Jaw.
1—1200 K.W. Lethbridge.
1— 750 K.W. Nova Scotia Steel & Coal Co.
1— 675 K.W. Medicine Hat.
1— 675 K.W. Medicine Hat.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Wayagamack Pulp & Paper Co.

The Siemens Companies manufacture Turbo Generators in **single units of 30,000 H.P.**

"The Siemens Companies undertake the complete electrical equipment of mines, collieries, steel works, rolling mills, pulp and paper Mills, and electrical plants of every description, and specialize in **Electric Hoisting Engines.**"

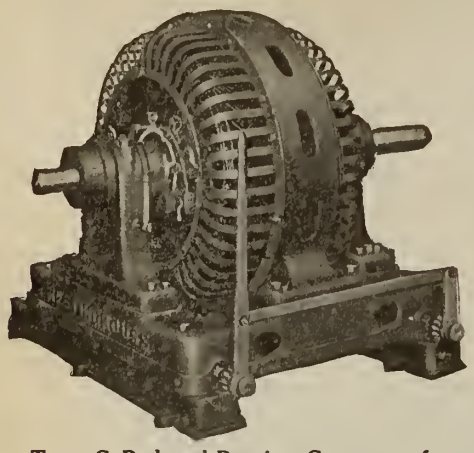
Siemens Company of Canada, Limited

HEAD OFFICE
TRANSPORTATION BUILDING - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG



Type G Pedestal-Bearing Generator for Capacities exceeding 75 kva.

The Most Popular Line of Belted Alternating Current Generators on the Market To-Day.

Westinghouse Type G

Built in capacities of 30 to 200 Kva, they are daily demonstrating to several hundred well satisfied customers their ability for long and hard service.

Type G Bracket-Bearing Generator for Capacities of 75 kva and smaller

They are cool even at heavy overloads and at low-power factors.

They are fitted with "damper" windings (except 30 and 50 kva sizes), and are, therefore, ideal for gas and oil-engine drive.

The bearings are of ample proportions, self-oiling and supported in an adequate manner, as shown in the accompanying illustrations.

Send for Descriptive Leaflet 2389

They have a simple, easily operated belt tightening mechanism.

They are as efficient as a machine of their capacity and type could well be, and are thoroughly reliable.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

—— FOR REGULATIONS, MAPS, ETC., APPLY TO ——

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M.A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

—— Published by ——

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

—— which also publishes ——

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

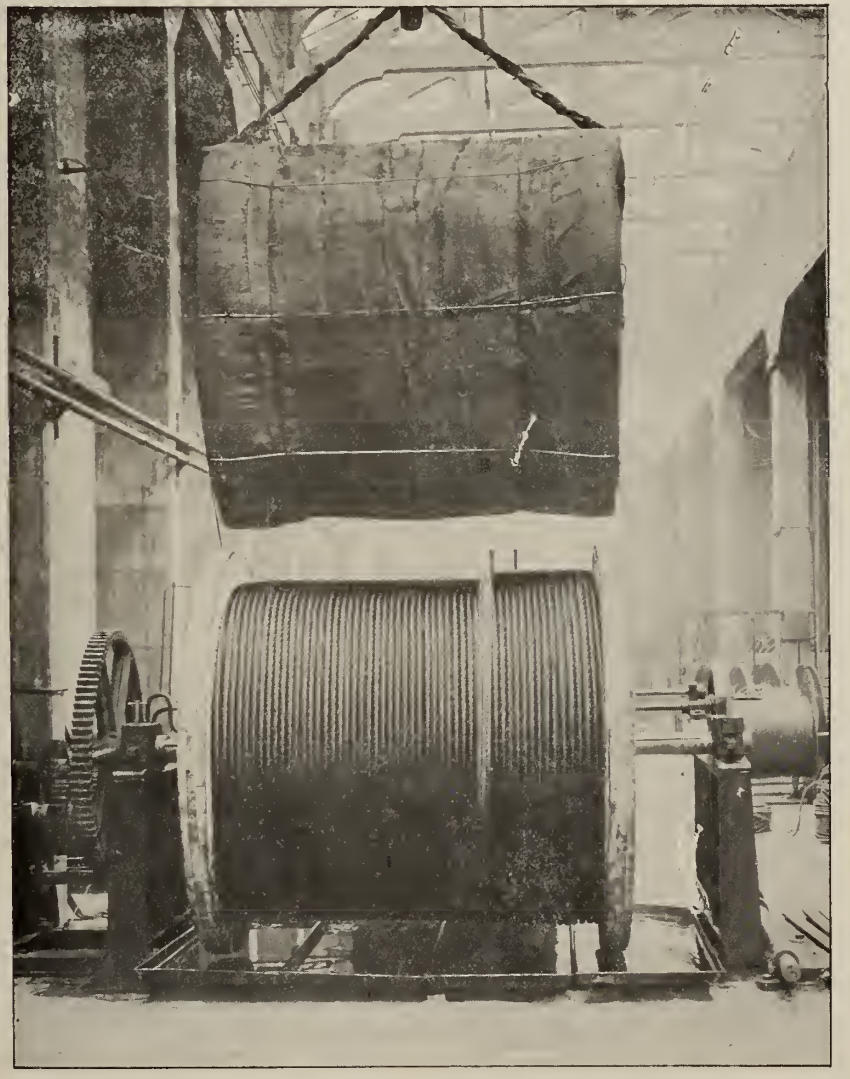
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

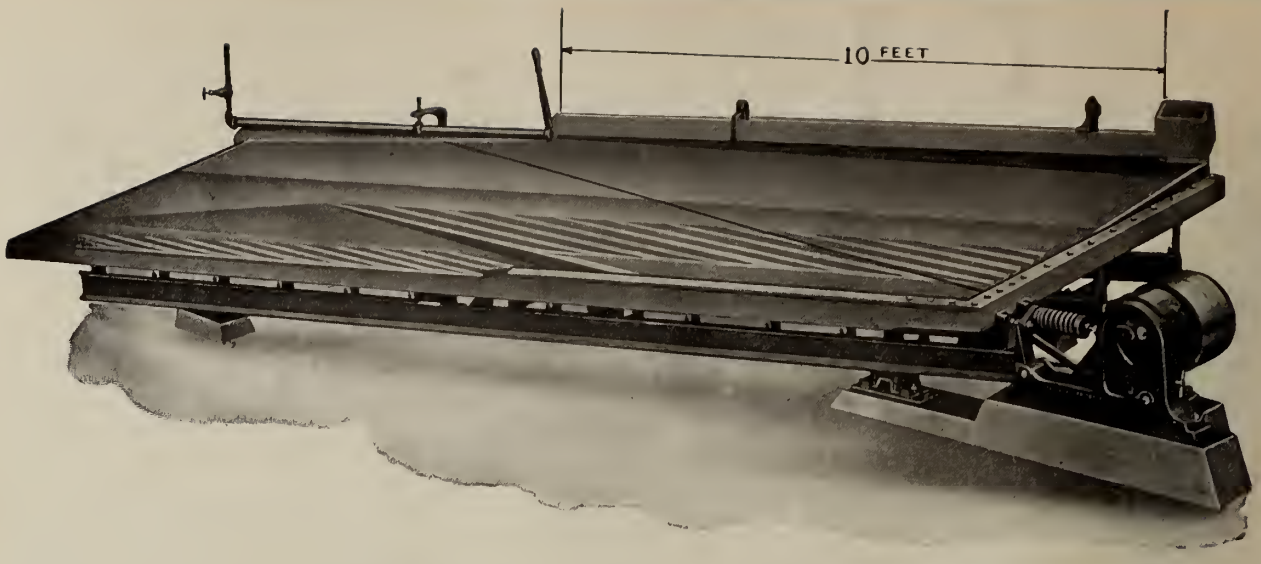
CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.

CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.



The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

CURTISS & HARVEY (CANADA) LIMITED
DRAGON BRAND

Annual Meeting Canadian Mining Institute

March 4th, 5th and 6th

at

MONTREAL

We will be pleased to see you at

400 St. James Street

Lt. Col. James J. Riley,
General Manager.

George Riley,
Sales Representative.

MARCH 1, 1914 Single Copies 15 Cents

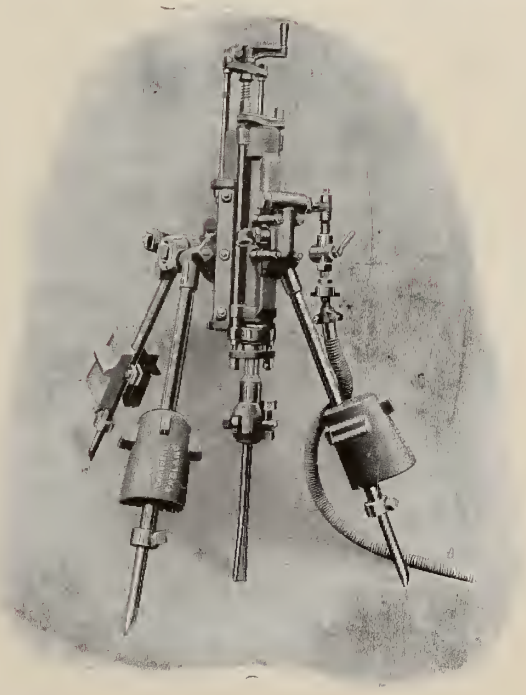
CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 5

NO MERE TALKING POINT--BUT A FACT

Latest Improvements *on the* HOLMAN TAPPET ROCK DRILL

Cover New Valve Features which make the HOLMAN an Absolutely Non-freezing Machine.



A Test made recently in the Cobalt Camp proves this statement.

The HOLMAN, fitted with new valve, operating on surface with thermometer registering 35° below zero, made a continuous run through fourteen shifts without a single stop from freezing, making a record drilling footage under these severe weather conditions.

Another victory added to the Holman's long list.

Install HOLMAN MACHINES and put an end to your freezing troubles.

WRITE FOR CATALOGUE No. 51

THE DRILL YOU WILL FINALLY BUY

MUSSENS LIMITED

MONTREAL, 318 St. James St. TORONTO, 155 West Richmond St. COBALT, Opp. Right of Way Mine WINNIPEG, 259-261 Stanley St. CALGARY, 10th Ave. and 3rd St. E.

VANCOUVER 101 Water St. QUEBEC 31 St. Louis St. ST. JOHN, N.B. 57 Symthe St. HALIFAX 78 Granville St.

IMPORTANT ANNOUNCEMENT !

WE desire to announce to our good friends and the trade in general, that we are endeavoring to further our interests in the MINING, ROCK CRUSHING and CEMENT INDUSTRIES, and from now on will manufacture a full line of the following equipment :

MINING - ROCK CRUSHING - CEMENT MAKING

Stamp Mills
Feeders
Crushers
Tube Mills
Slag Pots
Forehearths
Charging Cars
Smelting Furnaces

Gyratory Crushers
Crushing Rolls
Jaw Crushers
Rotary Screens
Elevators
Conveyors
Bin Gates

Crushers
Feeders
Pulverators
Ball Mills
Tube Mills
Rotary Kilns
Rotary Coolers
Rotary Dryers

ALSO ROCK DRILLS AND AIR COMPRESSORS

We have secured the services of Experts in the above lines, and will undertake to DESIGN, BUILD and ERECT COMPLETE PLANTS. Purchase here and Save Part of Duty Taxed on Machinery Made in the States.

GYRATORY *and* JAW CRUSHERS

with **Water-Cooled Eccentric Bearings** *in each*

SEND FOR ADDITIONAL INFORMATION

The JENCKES MACHINE CO., Ltd.

Main Office and Works - - - SHERBROOKE, QUE.
Western Works - - - - - - ST. CATHARINES, ONT.

DISTRICT OFFICES AT : MONTREAL, TORONTO, VANCOUVER, NELSON, COBALT, S. PORCUPINE

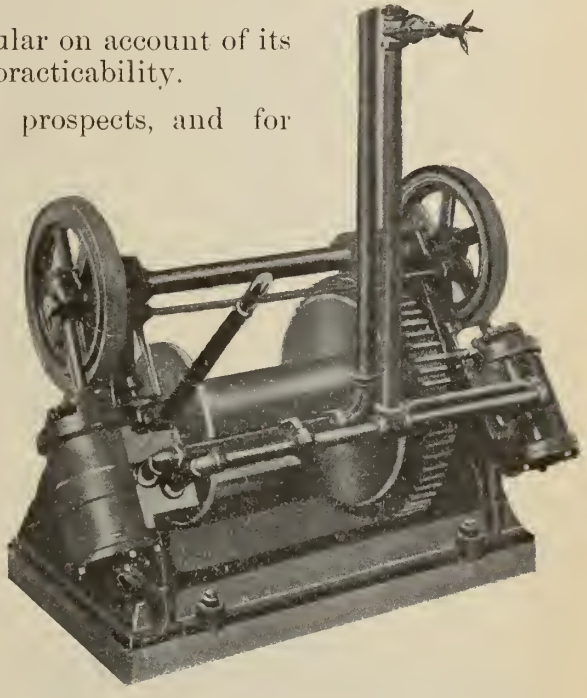
OTTUMWA HOISTS.

ANACONDA PROSPECTING HOISTS

WITH CUT GEARING

This type of hoist has become very popular on account of its simplicity, compactness, light weight and practicability.

It is especially adapted for developing prospects, and for inside work of large mines.



It is designed to run economically, with Steam or Compressed Air.

The Cylinders are of the Trunk Type, to allow for short connections to the Crank Shaft. They are placed in an incline position low down upon the base frame. The Crank Shaft is placed at the extreme top of the machine, permitting the Drum to be located near the base in the best position for resisting the Rope Pull.

The Gearing is cut from a solid Blank, and the pinion is made of steel.

The Drum is of conical friction type, and operated by hand lever, as shown by cut. Diameter of Drum 8 in.; length between Flanges 18 in.; diameter of large gear 22 9/16 in.; diameter of pinion 4 1/3 in.; bore of Cylinder 5 1/4 in.; stroke of Cylinder 5 in.; hoisting speed 125 feet per minute. Approximate shipping weight 1,300 lbs. Capacity of Hoist 1,500 lbs.

Agents for ———

The Bawden Sinking Pump. No Springs, Tappets or Outside Rods.

FJAB Rock Drill Steel, both hollow and solid.
Quality, Uniformity, Reliability, Economy.

Exclusive Canadian Agents for the OTTUMWA IRON WORKS.

——— *WRITE FOR PARTICULARS AND PRICES* ———

Rock & Power Machinery

Limited

P. H. MOORE - General Manager

HEAD OFFICE: 12 King St. East, Toronto. Ont.

BRANCH OFFICES:

VANCOUVER; CALGARY; WINNIPEG; SUDBURY;
COBALT; OTTAWA; MONTREAL; HALIFAX,
AND IN THE KING EDWARD HOTEL, TORONTO

Imperial Bank
of Canada

Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Paid Up	6,992,000
Reserve Fund	7,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

PRECISION MADE SAFETY LAMPS AND APPARATUS

to burn Benzine or Oil; to light electrically by small Magneto Dynamo, hand driven, or to light by Accumulators; Unlocked pneumatically or magnetically.

Made by the World's Safety Lamp Experts

ACKROYD & BEST, Ltd.

Morley, Leeds, England

For full particulars apply:

ACKROYD & BEST, Ltd.,

No. 2, Arrott Power Buildings, Barker Place, Pittsburgh, Pa. U.S.A.

Telephone Nos. { P. & A. Tel. Main 2217. Bell. Grant 1619.

UNIVERSITY OF TORONTO

FACULTY OF APPLIED SCIENCE AND ENGINEERING

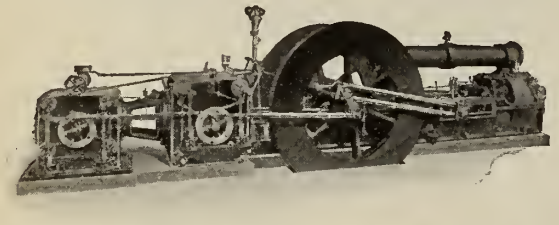
Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

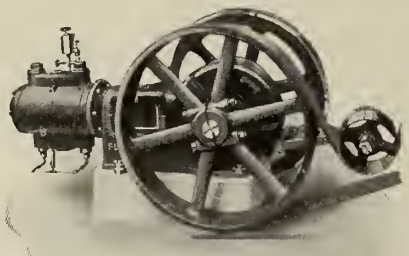
Leading to ACADEMIC and PROFESSIONAL Degrees.

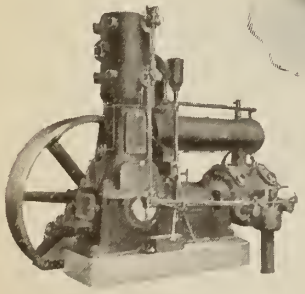
For Calendar and other information apply to the Secretary,

A. T. LAING



Sullivan Class "WC" Tandem Corliss Two Stage Compressor. Bulletin 658D





Sullivan Single Stage Air Compressor, Class "WG3" with Belt Tightener. Bulletin 658N.

Sullivan "WJ3" Angle Compound Compressor. Bulletin 658S.

SULLIVAN MACHINERY CO.,

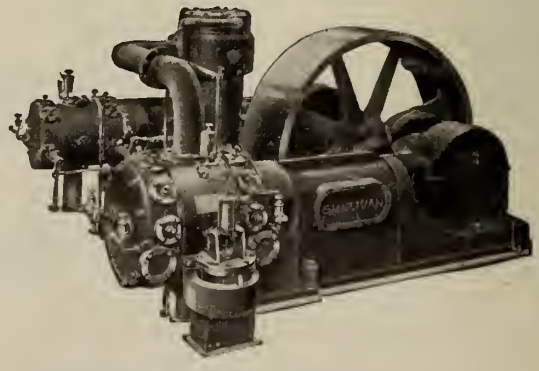
122 So. Michigan Avenue, Chicago

A Reminder That

SULLIVAN
AIR COMPRESSORS

are to be had in a large range of types and sizes, to suit any conditions of service—but built in only one grade—the best.

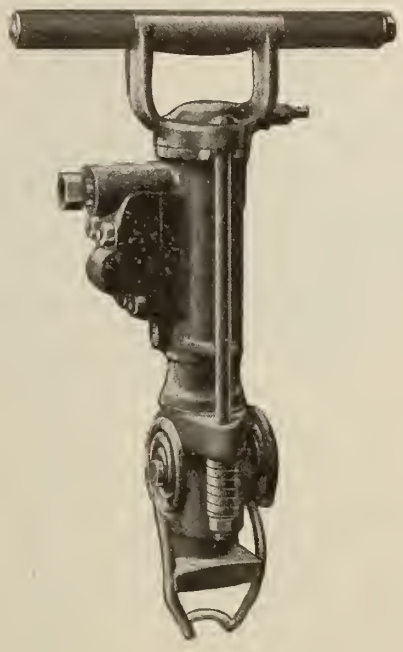
ASK FOR THE BULLETINS.



Sullivan Belt-Driven Two-Stage Air Compressor, Class "WJ2." Bulletin 658M.

These are Four of a Large Number of Styles.

The Hammer Drill Problem



The "Jackhamer" An All-Steel, Self-Rotated, Self-Lubricated Drill for Reducing Drilling Cost.

Consider the hammer drill and its duties. Do you know of any device upon which a heavier burden is laid?

It must be small and light and easily handled. Yet it must have within it the drilling capacity of many men—must withstand the tremendous tension of high-speed, high-pressure operation.

Design and materials count here to the utmost—design that makes the most of the power and does the most work—materials that will withstand the heavy duty without undue weight.

You'll find the most perfect design and the most rugged materials in Ingersoll-Rand Hammer Drills **—the hammer drills with forty-two years' experience in drill building to make them right.**

In the unequaled Ingersoll-Rand line is just the tool you need—each one specifically designed to meet specific conditions in the best possible manner. For heavy work and deeper holes, there is the "Jackhamer" Automatic Rotation Drill with the unique "Butterfly" Valve.

For lighter work and shorter holes there is the **"Butterfly" series of hammer and plug drills,** with the "Butterfly" valve, and the "Imperial" series of valveless tools.

The diversity of Ingersoll-Rand types is for your convenience and profit. The quality in the entire series is uniformly the highest.

What Users Think of the "Jackhamer"

FROM A QUARRY OPERATOR

"We have been using one of your "Jackhamer" drills for several months and find it to be a very efficient tool. In fact, one man can do more with a "Jackhamer" than ten men can do by hand. After having used one we would not attempt to do without it."

FROM A CONTRACTOR

"I wish to state that these drills are the best ever for this class of work. I have been working the deep trenches (sewer) with solid rock all the way, mostly sandstone. However, there has been some limestone to contend with, and they have handled this material in a very satisfactory manner. Trench 20 feet deep; solid sand and limestone from the surface. All drilling with "Jackhamer" run with steam. Average—35 5-foot holes per 8 hours per drill."

FROM A RAILROAD CONTRACTOR

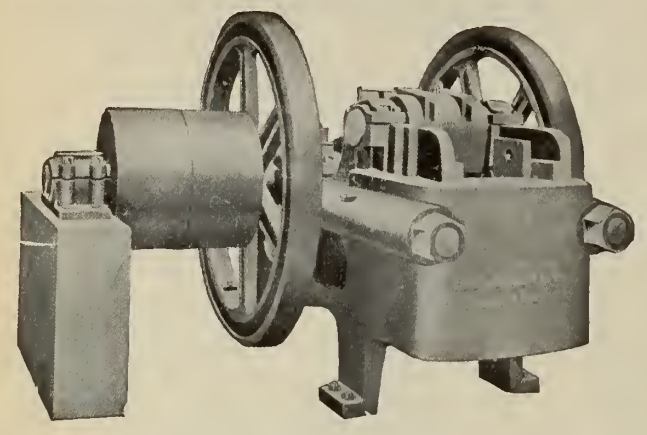
"We now have in use two of your "Jackhamer" steam drills, both of which are giving entire satisfaction. They are the only hammer drills we have ever seen that work successfully under steam pressure, and they are the only machines we ever saw that would cut a hole as deep as 6 feet without more or less trouble."

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver



BLAKE CRUSHERS, as designed and manufactured by Fraser & Chalmers Limited, are particularly adapted for crushing highly metalliferous ores.

Our Crushers are fitted with manganese steel jaw plates and side liners.

ALL SIZES CARRIED IN MONTREAL STOCK FOR IMMEDIATE SHIPMENT.

Write for Bulletin E.3

FRASER & CHALMERS OF CANADA

4 PHILLIPS PLACE LIMITED MONTREAL, P.Q.

GOLD

Its Geological Occurrence and Geographical Distribution

By MALCOLM MACLAREN

This is an excellent treatise, carefully written by a well-known authority on gold deposits.

It is the most comprehensive work on the subject, and contains authentic descriptions of gold deposits in all parts of the world.

Accuracy and brevity are notable features.

The volume is well printed and contains 278 illustrations.

The price is $7.50.

Book Department, Canadian Mining Journal

44-46 Lombard Street, Toronto

SARTORIUS BALANCE

MODEL

"AMERICA"

WRITE FOR DESCRIPTIVE CIRCULAR

LYMANS, LIMITED
MONTREAL

Try a "Cleveland" Stope Drill

If we could make a demonstration for the superintendent and foreman of each different mine running stopes, we know we could convince them of the fact that the "CLEVELAND" is the best Stope Drill made—for we have been successful in so convincing every superintendent for whom we have made a demonstration, and have received his order.

A special demonstration in every mine is out of the question—but why not let us send you one for trial

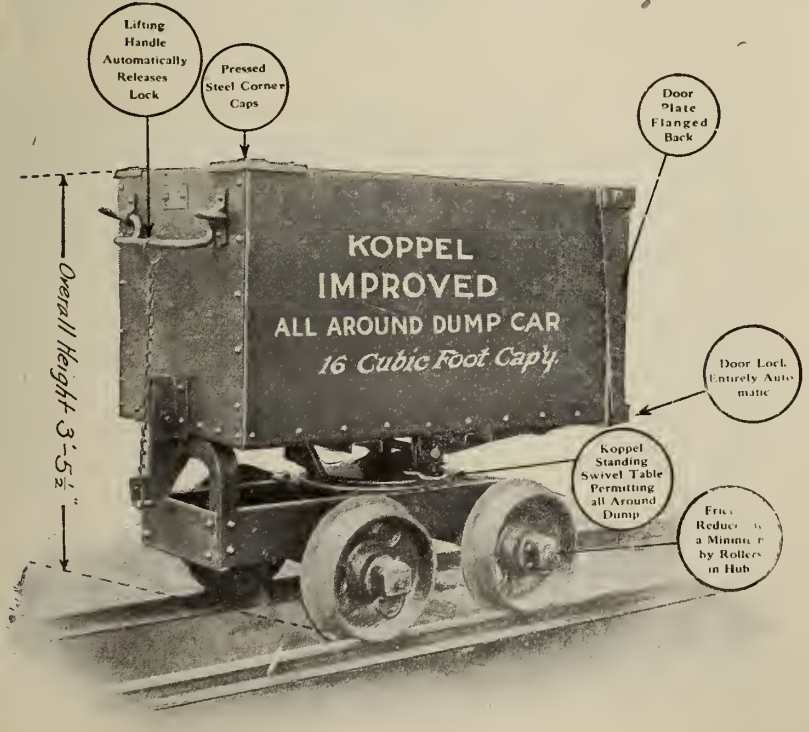
IN YOUR OWN MINE

so you can find out for yourself what it will do.

Write for Bulletin 40A.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street - TORONTO

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Capy.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

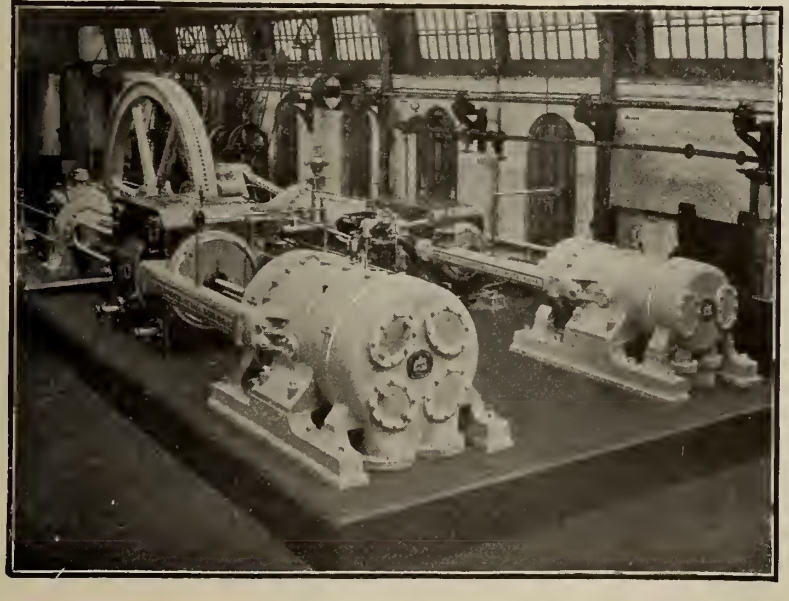
THE SUPREME METAL
FOR WEARING PARTS

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

The Canadian Bank of Commerce

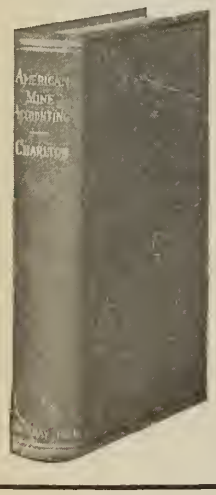
PAID-UP CAPITAL, $15,000,000
RESERVE - - 13,500,000

DRAFTS ON FOREIGN COUNTRIES

Arrangements have recently been completed under which the branches of this Bank are able to issue Drafts on the principal points in the following countries.

Austria-Hungary	Fr'ch Cochin-China	Norway
Belgium	Germany	Persia
Brazil	Great Britain	Phillipine Islands
Bulgaria	Greece	Roumania
Ceylon	Holland	Russia
China	Iceland	Servia
Crete	India	Siam
Denmark	Ireland	South Africa
Egypt	Italy	Straits Settlements
Faroe Islands	Japan	Sweden
Finland	Java	Switzerland
Formosa	Manchuria	Turkey
France	Mexico	West Indies and elsewhere

No Delay in Issuing. Full Particulars on Application.



American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages*, 6*x*9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

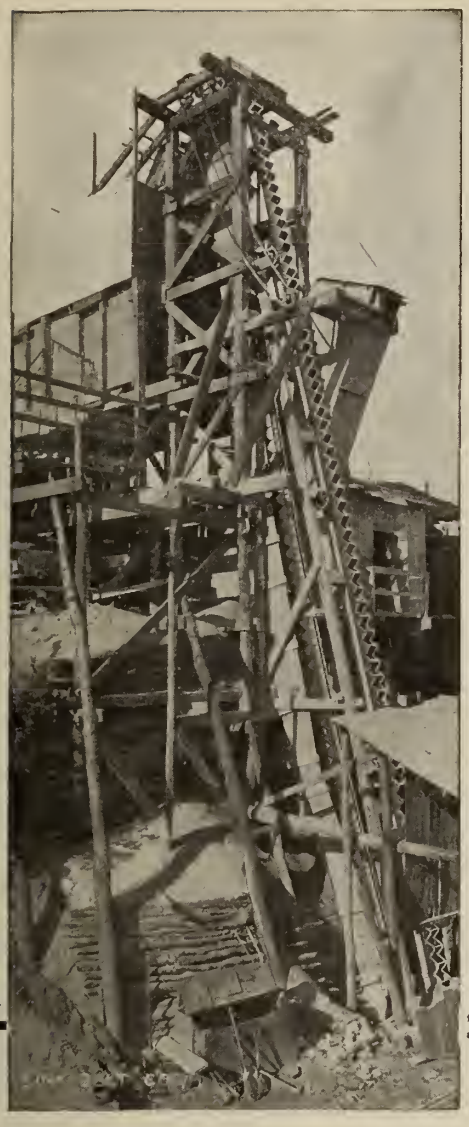
The International Nickel Co.

43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)



Cut the cost of handling your ores, limestone, coke, coal, etc., by doing the work with

WATEROUS
STEEL BUCKET
ELEVATORS

We furnish Link Belt Elevators and Conveyors in sizes up to 600 tons per hour capacity, specially designed to suit individual conditions.

These Steel Bucket Equipments are sure, fast and economical if they are installed right. We have had years of experience at the work and can put in an installation that will cut costs for you.

If you have a transport problem—put it up to us. Our advice is free and puts you under no obligation.

The Waterous Engine Works Co.
Limited
BRANTFORD -:- CANADA

MINE TELEPHONES

—save time, prevent errors and increase efficiency. They closely coordinate a number of departments working independently, into a compact, harmonious, organization.

In case of emergency they make it possible to send warning and give instructions to all departments at the same instant.

Let us send a man from our nearest house to study the telephone requirements of your mine.

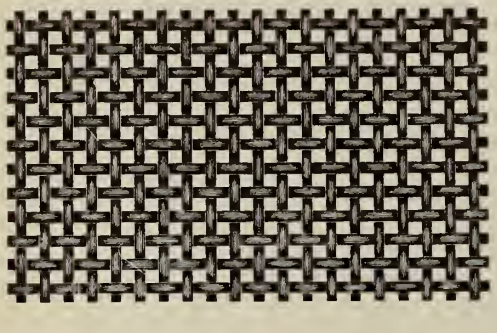
THE Northern Electric AND MANUFACTURING CO. LIMITED

Makers of the Nation's Telephones

MONTREAL	WINNIPEG	EDMONTON
HALIFAX	REGINA	VANCOUVER
TORONTO	CALGARY	VICTORIA

GREENING'S

WIRE CLOTH - WIRE SCREENING



ALL GRADES OF WIRE CLOTH
DOUBLE CRIMPED

Screening Accuracy guaranteed.

Made of Steel, Copper or Brass.

Galvanized and Tinned Cloth.

PERFORATED METALS WIRE ROPE

The B. GREENING WIRE CO., Ltd.

HAMILTON, ONT. MONTREAL, QUE.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 1 4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, NOVA SCOTIA

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

Won't this ROBB

MINE HOISTING ENGINE

just suit you ?

Two Robb-Armstrong side-crank engines, 22 inches diameter by 42 inches stroke. Engine bearings hard babbit.

Two Drums 8 feet in diameter, 58 inches wide. Bronze sleeves.

New, complete, with steam brake, steam-operated clutch, throttle valve, etc.

FULLY GUARANTEED.

For Photos, Drawings, etc., write to

International Engineering Works Limited
AMHERST, N.S.
Transportation Building. Montreal
Traders Bank Building, Toronto
39-49

"BEATTY"

Material Handling Plant

Hoisting Engines
Clamshell Buckets
Steel Derricks
Derrick Irons
Centrifugal Pumps
Dipper Dredges
Steel Scows, Etc.

Your requirements for anything in this line can be promptly filled by us, for we have a big stock of finished plant ready for immediate shipment, so are in fine shape to serve you.

Let us know your needs—we can interest you.

M. BEATTY & SONS, Limited
WELLAND, ONTARIO

AGENTS:
H. E. Plant, 1790 St. James St., Montreal.
H. W. Petrie, Ltd., Toronto
E. Leonard & Sons, St. John, N.B.
R. Hamilton & Co., Vancouver
A. R. Williams Machinery Co., Winnipeg

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records
Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

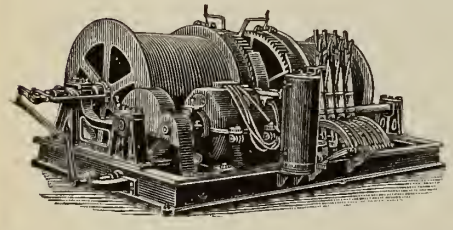
HEAD OFFICE AND FACTORY **TORONTO** BRANCH FACTORIES **WINNIPEG** AND **MONTREAL**

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

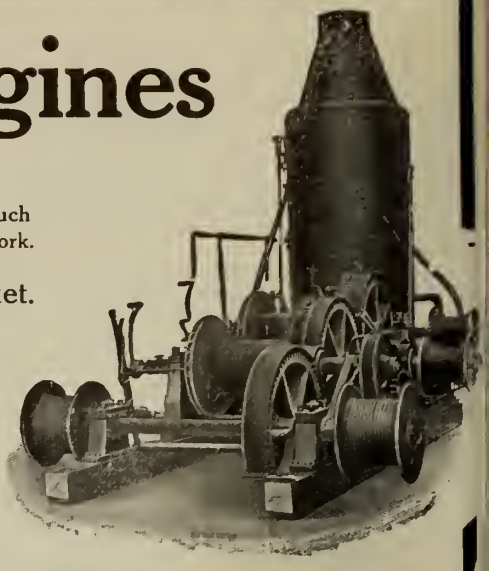


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

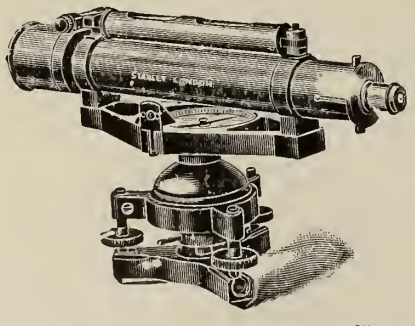
SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade STANLEY Mark

The largest manufacturers of

Surveying and Drawing Instruments

in the world.



"Stanley Quick-Setting-Up Level"

Please send for our K 35 Catalogue (post and duty free) and compare our prices with those of other first-class makers.

W. F. Stanley & Co., Limited

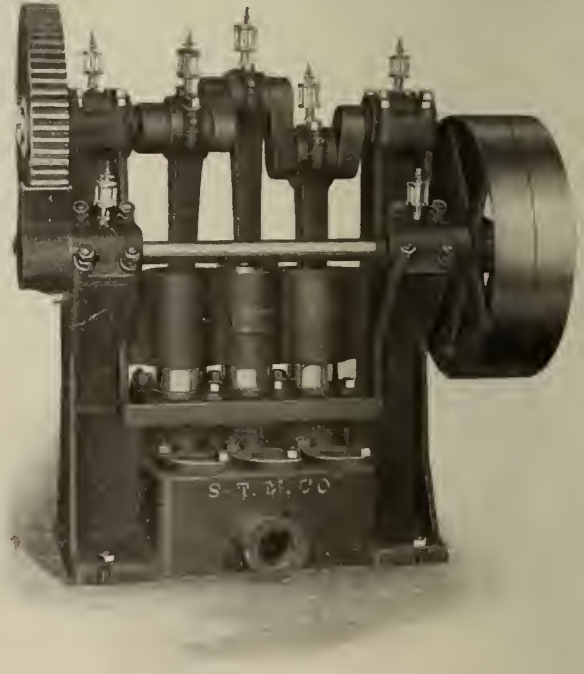
Export Dept.: Great Turnstile, London, W.C.

Head Office and Showrooms:

286, High Holborn, London, England

WE STAND BEHIND OUR PUMPS

Entire Satisfaction Guaranteed. Write for Our Catalogue.



The Smart Turner Machine Co.
LIMITED
Hamilton, Canada

BAGS!

Jute Cotton Duck

FOR

ASBESTOS COAL ORE

CONCENTRATES

FLOUR GRAIN FEED

PRINTING A SPECIALTY

The Canadian Bag Company Limited

Head Office: Montreal

TORONTO WINNIPEG

Amatite ROOFING

Figure It Out Yourself!

THE proposition is so simple that it hardly needs figuring. It is simply this: Most of the ready roofings on the market have a smooth surface which *requires painting every year or two.*

Amatite has a real mineral surface that *needs no painting.*

The cost is about the same.

If you buy a roofing that needs painting, you must figure on the expense of paint and the labor. If you neglect to paint it the roof soon falls apart.

Anyone who will spend a few moments investigating the proposition cannot help but decide on Amatite. Sample and booklets free on request.

THE PATERSON MFG. CO., Limited

Montreal, Toronto, Winnipeg, Vancouver, St. John, N.B., Halifax, N.S. Sydney, N.S.

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets. Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

All Ready!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

THE JOURNAL OF COMMERCE WITH WHICH IS INCORPORATED The Shareholder

TWO of the oldest and most reliable Weekly Journals, recently amalgamated to strengthen the work heretofore done by each in the field of Commerce, Finance, Insurance and Industry. Editor, *J. C. Ross, M.A.*

Canada's greatest asset is her natural resources and the commodities by which she is best known are the products of industries engaged in the development of these resources. Canadian **ASBESTOS, NICKEL** and **COBALT** control the Markets of the world for these commodities, while her **SILVER, PULP** and **PAPER,** and **GRAIN** and **GRAIN PRODUCTS** are dominant factors of the world's supplies. The only Periodicals which are devoted entirely to these industries are :

CANADIAN MINING JOURNAL, published twice a month. Editor, *Reginald E. Hore, B.A.*

PULP AND PAPER MAGAZINE OF CANADA, published twice a month. Editor, *A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST, published once a month. Editor, *J. G. Adams, B.A.*

CANADIAN TEXTILE JOURNAL, a monthly periodical devoted entirely to Textile Manufacturing, is published from the same Offices. Editor, *E. Stanley Bates.*

In addition to publishing the above mentioned Journals, we are especially equipped to do all kinds of

FINE BOOK, CATALOGUE AND JOB PRINTING

MONTREAL OFFICE
Industrial and Educational Press, Limited
Read Building

TORONTO OFFICE:
Industrial and Technical Press, Limited
44-46 Lombard St.

MINE RAILS

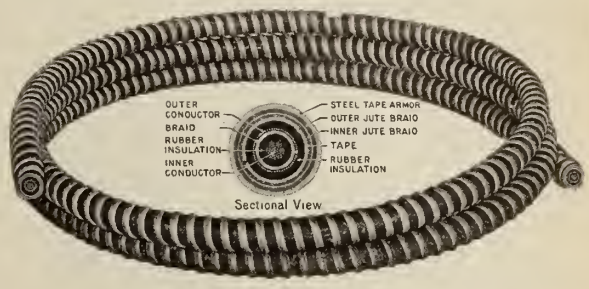
12 to 45 Pounds

PROMPT SERVICE.

H. A. DRURY CO.

LIMITED

MONTREAL and TORONTO



When You Buy

your supply of mining machine cable remember that the greatest economy lies in durability and reliability not in low first cost.

STANDARD "Wearproof" Mining Machine Cable

is not made for mere price competition but to give long and satisfactory service, as will be apparent from an examination of its construction illustrated above.

For samples and prices write our nearest office.

Standard Underground Cable Co. of Canada, Limited
Hamilton, Ont.

Montreal, Que. **Winnipeg, Man.**
Boston, Mass. **Seattle, Wash.**

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

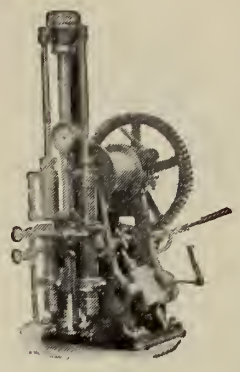
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

POSITION WANTED

Mechanical Construction Engineer and Draughtsman, experienced Designer and Erector of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc., seeks position. References.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

CYANIDE PRACTICE
1910-1913

Edited by
M. W. von Bernewitz

732 pages, 6x9 in.
140 illustrations.

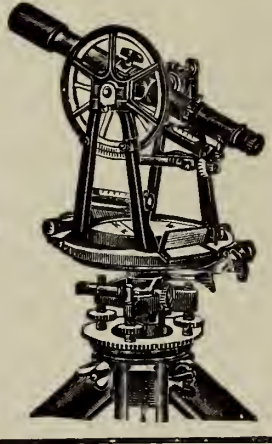
Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings:

Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto



C. L. BERGER & SONS

37 Williams Street
BOSTON, - MASS.

SPECIALTIES:
Standard Instruments and Appliances for
Mining, Subway, Sewer and Tunnel, and all kinds of Underground work.

SEND FOR CATALOGUE

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

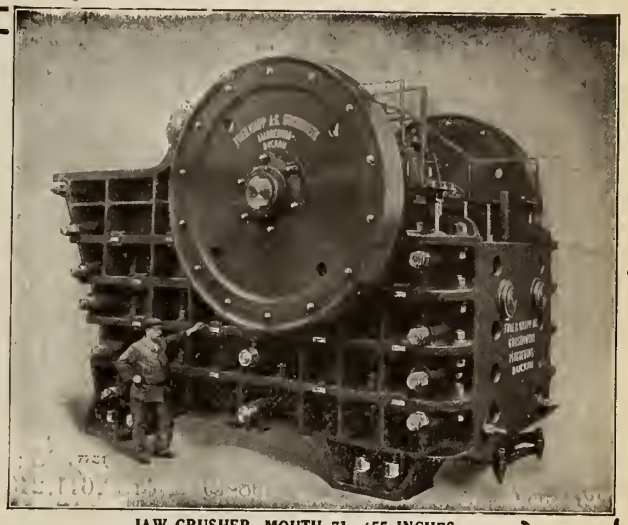
"KRUPP"

MINING-MACHINERY

Ore and Rock Breakers, Rolls, Stamps, Shoes and Dies of Special Krupp Steel, Krupp Ball Mills for Dry and Wet Crushing Ores, Chilian Mills (Edge Runners).

TUBE MILLS FOR WET GRINDING

Concentration-Amalgamation-and Cyanide-Plants.



JAW CRUSHER, MOUTH 71 x 55 INCHES

WET GRINDING TUBE MILLS.

ULLRICH'S Patent Electro magnetic Dry and Wet Separator for strongly and feebly Magnetic Ores.

COMPLETE INSTALLATIONS

for the

TREATMENT of ORES of every kind

Plants for the Metallurgical Treatment of Ores.

FRIED. KRUPP A.-G. GRUSONWERK

MAGDEBURG (GERMANY)

Canadian Representatives:

JAS. W. PYKE & CO., Limited, 232 St. James St. Montreal

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST — LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS

211 Board of Trade Bldg.
MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. — ENGINEERS and MANUFACTURERS — OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM
(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

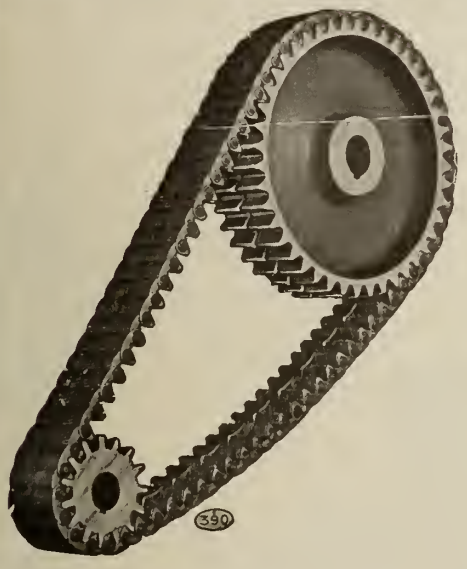
B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD (PATENT) SILENT CHAINS



Regularly applied for driving:—

Chilian Mills	Fans	Rolls
Crushers	Blowers	Stamp Mills
Deister Tables	Jigs	Lineshafts
Elevators	Pumps	Haulages, etc.

Renold Chain runs either Forward or Backward, Fast or Slow, is not affected by Heat, Cold or Moisture, and is particularly Suitable to Short Centres.

Write for Catalogue and Particulars. Chains and Repairs stocked in Montreal.

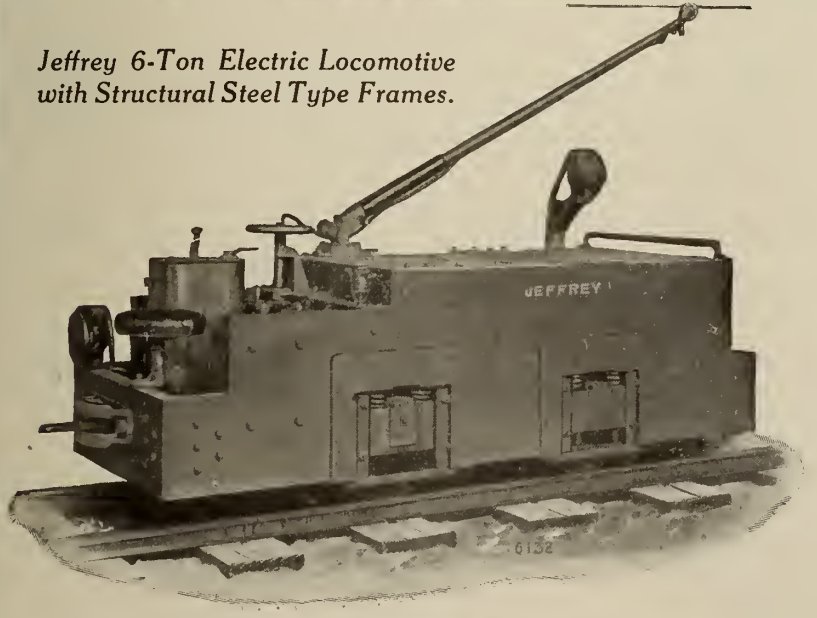
JONES & GLASSCO, (REG'D) Engineers

Sole Canadian Agents

Branch Office, Toronto. 49 Place D'Youville, MONTREAL

RENOLD PATENT SILENT CHAINS

Jeffrey 6-Ton Electric Locomotive with Structural Steel Type Frames.



Heavy Continuous Mine Haulage Demands Locomotives Exactly Suited to the Conditions.

JEFFREY
Electric Locomotives

equipped with Structural Steel Type Frames, Heavy Capacity Ball Bearing Motors, are unsurpassed for Metal Mine Service.

Structural Steel Type Frames, used on Jeffrey 4, 5 and 6-Ton Haulage and Gathering Locomotives, give a strong rigid construction; permit of large motor capacity for a given weight of locomotive.

The Heavy Capacity Ball Bearing Motors are of ample power to slip the wheels continuously without overload to any part.

The Ball Bearings practically eliminate bearing wear on the armature shaft (the cause of nine-tenths of motor troubles.)

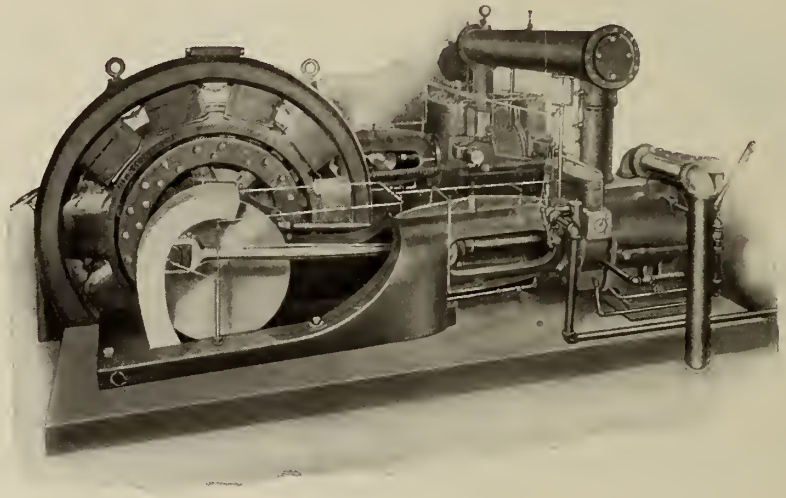
You will find our Mine Locomotive Bulletin No. 117 of considerable interest. Send for copy TO-DAY.

THE JEFFREY MANUFACTURING COMPANY

Canadian Main Office and Works: MONTREAL

TOTAL OPERATING COST

MEASURES THE VALUE OF AN AIR COMPRESSOR



The total operating cost includes fuel, labor, maintenance and interest and depreciation on the investment.

Fuel cost alone will equal investment in 2 to 5 years, hence first cost is a small factor.

Although the first cost of Laidlaw-Dunn-Gordon Compressors may slightly exceed that of some others, this is more than offset by the remarkable operating economies.

You will find this statement worth investigating. Begin by sending for Bulletin L518.

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, March 1, 1914. No. 5

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd 1879."

CONTENTS.

Editorial—	Page.
The Canadian Mining Institute	145
Sinking Shafts in Wet Ground	146
The Eight-Hour Shift	146
American Institute of Mining Engineers	146
Correspondence—	
Employers' Liability	148
Electric Smelting of Canadian Iron Ores, by T. R. Loudon	150
Manganese Steel, by W. S. Potter	153
The Present Status of Oxygen Breathing Apparatus, by F. W. Gray	154
Placer Mining in the Klondike, by D. D. Cairnes	156
Comparison of Mining Conditions in the United States today with those of 1872, by R. W. Raymond	159
Vancouver Island Labor Troubles	162
Checking the Flow of Water into Shafts by the Use of Cement Grout, by Francis Donaldson	165
British Columbia Coal Commissioner's Report	166
Gowganda Silver Deposits, by W. H. Collins	168
Michigan Copper Deposits, by R. E. Hore	170
Book Reviews	174
Personal and General	175
Special Correspondence	176
Markets	180

THE CANADIAN MINING INSTITUTE

This week there will be held in Montreal the annual meeting of the Canadian Mining Institute. Members are urged to be present, and they should take advantage of the privilege of bringing friends who are interested in mining. Invitations may be secured on application to the Secretary. The meeting is to be held at the Ritz-Carlton Hotel, where special rates for members have been arranged for.

The council reports for 1913 another very successful year. At the meeting in Ottawa last March there was a large attendance. Branch meetings were held at Montreal, Toronto, Cobalt, Lethbridge, Frank, Rossland and Nanaimo. In addition to the annual volume an Index to Transactions was published. The Index cost, according to the Treasurer's report, $1,606.02. Fewer papers were published in advance form than in previous years, the council having decided that economy demanded this.

The Index was prepared by the Secretary, Mr. Mortimer-Lamb. It is a useful source of reference to the papers published in Volumes 1 to 10. In addition to the general index there are summaries of the papers.

The annual volume comprises 660 pages, is well illustrated and is printed on good paper. It is, as Dr. Barlow points out, a much more costly volume than was published a few years ago.

The membership on Dec. 31, 1913, was 1,029, as compared with 1,035 on Dec. 31, 1912. The decrease was in the number of affiliated students. The number of ordinary members increased.

A notable feature of the Institute's activities during the year was the International Geological Congress. As Mr. Lamb points out, the Institute was not officially responsible for the conduct of the meeting; but much of the work was done by members of the Institute. The Council recognized that the Congress meant much to the mining industry in Canada and acted accordingly.

In the students' competition eight papers were submitted. The President's gold medal and the first prize of $25 were awarded to Mr. C. W. Greenland of the School of Mining, Kingston. Mr. P. P. Baily of McGill University was awarded second prize. Messrs. C. S. Parsons of the School of Mining and Mr. E. E. Billington of McGill were awarded honorable mention.

The Canadian Mining Institute has a good name for what it has accomplished, and it is gradually growing in usefulness. It represents the mining industry in Canada and can claim to have as a rule represented it well.

There are, however, occasions when it becomes apparent that some members are of the opinion that a

number of reforms are desirable. It is to be expected that there will be much difference of opinion. This has been provided for by endeavoring to make the Council a truly representative body. Some are of the opinion that the methods of election do not guarantee this. Some complain that they are not kept reasonably well informed of the action of Council. Some complain that other reforms are needed.

It would be well if members who have reforms to suggest would make their suggestions to the Council in order that they be given due consideration. And it would be well if the Council would keep members better informed as to their actions. A little publicity would probably show that some of the grievances are ill-founded and that others could be easily remedied. As a rule the criticisms offered are not on very important matters, and are hardly worthy of the attention of the annual meeting.

As a rule Institute affairs run along very smoothly, and would probably continue to do so without radical changes in methods. Difficult questions have arisen frequently and have been successfully disposed of. There are, however, always some discontented members. Greater endeavor might be made to remove the reasons for discontent. Possibly similar reasons are responsible for some good mining men in Canada not joining the Institute.

The retiring president, Dr. A. E. Barlow, has long been an enthusiastic supporter of the Institute. He has given much of his time to furthering its interest and will be able to present a good report. His successor is Mr. G. G. S. Lindsey. Mr. Lindsey is not a geologist, but is otherwise well qualified for the position.

SINKING SHAFTS IN WET GROUND

Among the papers presented at the New York meeting of the American Institute of Mining Engineers was the one on grouting which appears elsewhere in this issue. The author gave a very interesting account of the successful exclusion of water from underground openings. He believes that the methods used are applicable in many cases. The chief difficulty is in sandy ground.

Where the openings are in rock, as most mine openings are, the use of cement grout for the exclusion of water is well worthy of consideration. There are many obvious advantages to be gained by preventing the flow of water into shafts. If it can be economically done, as Mr. Donaldson believes, there is reason to believe that it will become common practice.

THE EIGHT-HOUR SHIFT

Since December 1, 1913, the underground employes of the Michigan copper mining companies have been required to work only eight hours each day. In a recent issue we stated, in error, that the law required this. A bill providing for the eight-hour shift was under discussion last summer; but was not passed by the State Legislature. Some time later, however, after the Western Federation strike was declared, the mine managers announced that they were willing to grant the demand for an eight-hour day. They had had this under serious consideration for some time, and might have granted it without a strike if they had not found that it is much more difficult to put the eight-hour rule in force than might be expected. There can be little doubt that the strike hastened the determination of the mine managers to try the experiment.

The Michigan copper mines are, by those who know, regarded as mines in which the conditions are very favorable for good work. The ventilation, in spite of the depth of the mines, is good. The machines are usually the best obtainable and are kept in good repair by skilled mechanics. The steel, powder and other supplies used are those which are found by constant testing to give the best results. The managers believe in doing everything possible to increase the efficiency of the workers. Under the conditions obtaining a miner should be able, and is able, to do a good day's work in eight hours.

As a matter of fact there is good reason to believe that few of the miners on company account really worked more than eight hours under the old regulations. The workmen in a large mine are in small groups so far apart that no reasonably economical system of watching the men as is done on surface work is possible. Only occasionally are the workers visited by the shift bosses. They must be judged by the work done between visits. While frequent complaints are made regarding the treatment by bosses, it must be evident that no such surveillance as is practised by foremen on surface work, such as railroad construction, is possible. There are abundant opportunities for loafing. It would be remarkable if the men did not take advantage of such opportunities. The experience of mine managers has proven that mine workers are much like other men.

It is easy to conclude therefore that the results to be obtained under the new regulations depend largely on the spirit in which the men accept the change. In proportion as they work a larger percentage of the time they are supposed to work, the total work done in the shorter shift will approach the old figures. The systematic records of the Michigan copper mining companies should prove very interesting in this connection.

While the strike seems to have failed, and has, owing to the methods of those responsible for it, been a disgrace to organized labor, it has doubtless hastened the adoption of new policies which should make the life of the copper miner more attractive.

AMERICAN INSTITUTE OF MINING ENGINEERS

The annual meeting of the American Institute of Mining Engineers was held in New York February 17-20, 1914. Those present, and there was a large

attendance, showed that they were much pleased with the progressive manner in which the Institute's affairs have been carried on by the officers during the past year. An energetic campaign to increase the membership resulted in several hundred applications being filed. An unusually large number of interesting papers were presented during the year. Nearly 500 members are on the many committees appointed.

Some members doubt the advisability of the methods of our American friends. They fear that the enthusiasm will not last and that the reaction will outweigh the good that has been done. So far, however, there is little ground for such fear. The members, as a rule, though not all by any means, are apparently confident that the revival has been a good thing for the Institute. The several hundred new men are well qualified, most of them having good technical training and several years' experience in mining.

During the past year many Canadians were invited to join the American Institute and several did. As a result of this, and more particularly on account of the way in which members were asked to take part in the campaign, there has been some criticism by Canadians of the American methods.

The criticism was taken seriously by the officers of the American Institute and a committee was appointed to confer with a committee of the Canadian Mining Institute on the matter. There does not appear to be any good reason for such action. The American Institute does not enter Canada under any more favorable terms than the Canadian Institute enters the United States. There are Canadian members of the American Institute and American members of the Canadian Institute, and it is generally acknowledged that this is as it should be.

If Canadian members of the American Institute of Mining Engineers wish to criticize the methods of the officers of that Institute they can do so just as do American members. Why should the matter be taken up with the Canadian Mining Institute? Apparently the criticism by a few members is being mistaken for criticism by Canadian members in general. The officers of the American Institute are taking the matter seriously, as they do not wish their activity to be misunderstood.

Under the heading "Fifty Years Ago To-day," The Daily Colonist, Victoria, B.C., lately included in the news items quoted from The Colonist of January 27th, 1864, the following: "Annual Gold Shipment—The gold shipments from Victoria to San Francisco for the year 1863 were $4,500,000, $10,000 of which went to San Francisco, then to New York, and the rest went to England, to avoid the war risk." In this connection, it is of interest to note that the Annual Report of the Minister of Mines shows the value of placer gold produced in the Province in 1863 to have been $3,913,563.

It has been announced that a committee of the Association of Bituminous Coal Operators of Central Pennsylvania, is considering the question of bringing action against the United Mine Workers of America as an organization, and leading members individually for alleged violation of a contract between the operators and the union miners in the Central Pennsylvania district. The operators state that more than 100 strikes have occurred in the district through the efforts of miners to unionize workers in the mines, and that the strikes are maintained by the miners' unions supplying the strikers with relief pay.

DR. A. E. BARLOW
President Canadian Mining Institute

MR. G. G. S. LINDSEY
President-elect

CORRESPONDENCE

EMPLOYERS' LIABILITY.

The Editor, The Canadian Mining Journal,
Toronto, Ont.:

Sir,—As, of course, you are aware, for some years past the Canadian Mining Institute has displayed a keen and practical interest in the movement to promote safety in mines. It will be agreed that mining corporations voluntarily adopting measures to minimize the dangers of mining and to ensure the safety of their employes should receive every encouragement. In the Bill about to be introduced to the Ontario Legislature relative to Employers' Liability and Workmen's Compensation, no discrimination is, I believe, made between mining companies that are safeguarding their employes in this respect and those that are not. May I suggest that this is scarcely fair. Those corporations that are making large expenditures annually to prevent, or, at least reduce, the risk of accidents at their mines and works should surely not be required to contribute in an equal degree towards covering the liability of employers elsewhere in the Province who have taken no such precautionary and humanitarian measures. In this Bill, a classification of mining companies under two heads—those that adopt safety methods and those that do not—would, therefore, not only be a just provision, but an incentive towards a more general introduction of "safety principles and practices."

H. MORTIMER-LAMB.

NEW PROVISIONS IN PETROLEUM AND GAS REGULATIONS.

By order in Council, January 14th, 1914, the following new provisions have been inserted in the Dominion petroleum and natural gas regulations:

1. No application for a lease shall be accepted or recorded unless it is accompanied by the full amount of the rental for the first year, viz.: 25 cents per acre.

2. Provision is made for the consolidation of operations and expenditure on a group of leases where more than one have been acquired by assignment or otherwise, provided that such consolidation shall only apply to the second and third years of the term of the lease, and shall comprise only such leases as may, at that time, be included in such consolidation. The group shall not exceed an area of 20 square miles, nor shall the locations be separated from each other by more than two miles.

3. Provisions are made with regard to preventing access of water to the oil-bearing formation and that all reasonable precautions be taken to guard against the waste of natural gas.

4. Any company acquiring leases shall at all times be and remain a British company, registered in Great Britain or Canada; the Chairman and a majority of the directors shall, at all times, be British subjects and the Company shall not at any time, become, directly or indirectly, controlled by foreigners or by a foreign corporation.

5. The Minister may at any time, if considered necessary by the Government of Canada, assume absolute possession and control of any location, together with plant, equipment, etc.

6. If oil in paying quantities is discovered, the lessee shall work the wells uninterruptedly in accordance with the provision of these regulations and to the satisfaction of the Minister so long as the wells yield oil in paying quantities.—W. J. D.

SALT.

Extensive beds of salt or salt producing springs are found in nearly every province of the Dominion of Canada.

The largest and at present the only producing district, is situated in the south-western peninsula of the Province of Ontario, bordering on Lake Huron, the St. Clair River, Lake St. Clair, and the Detroit River. The salt here exists as beds in the Salina formation of the Silurian system, which formation in the productive area is covered by upwards of 1,000 feet of other strata, chiefly Devonian.

In this district the principal plants are located at Windsor, Sarnia, Sandwich, Goderich, Clinton and Kincardine. A prominent feature of the salt produced from the brine in Canada is its remarkable purity and also its freedom from other salts detrimental to its use in the production of caustic soda and bleaching powder. There is a good opportunity for the soda industry in the Dominion and it is assuming larger proportions each year. At Sandwich, a plant has been recently erected for the manufacture of caustic soda and bleaching powder from the brine.

The production in Canada is obtained wholly from the evaporation of salt brines, either natural or else formed by the pumping of water down drill holes to the salt beds and the re-pumping of the water when it has become a saturated solution.

MICA.

The amber mica deposits of Canada are comprised within an area of approximately 1,200 square miles in the Province of Quebec, and 900 square miles in the Province of Ontario. The two districts are separated geographically by the Ottawa River, and geologically by a belt of sedimentary rocks about 40 miles wide. The City of Ottawa lies between the two productive areas, and is the seat of the mica industry—all the important works engaged in trimming and in otherwise preparing the mineral for the markets being located in that place.

Deposits of white mica also occur in Canada, and occurrences of this variety (some few of which have been worked at various times), are known from Labrador in the east to the Rocky Mountains in the west, while several Arctic expeditions have returned with good specimens from the far north.

Though the average dimensions of mica sheets do not much exceed 3 x 5 inches, plates of enormous size are sometimes obtained. Crystals have been found which measured over 4 feet across and weighed nearly two tons.

About 300 mines have been worked for mica at various times in Canada, but at the present day no more than 25 are in active operation. Among the large operators may be named: The General Electric Company, of Schnectady, N.Y.; Webster & Company, Ottawa; Blackburn Bros., Ottawa; Wallingford & Company, Ottawa; O'Brien & Fowler, Ottawa; Kent Bros., Kingston.

GRANBY.

Total shipments from the Granby mines at Phoenix, B.C., have now reached a total of 10,000,000 tons.

Mail carriers at Elk City, Idaho, were recently informed that owners of mining properties had three carloads of concentrated ore awaiting shipment by parcel post to the smeltery, a distance of 60 miles over mountain roads.

Members of C1 and C2 Excursions at Alexandra Club, Victoria, B.C.

Members at the University of Toronto, Headquarters During the Toronto Session.

ELECTRIC SMELTING OF CANADIAN IRON ORES

By T. R. Loudon, Toronto.

It is a well known fact that Canadian iron ores are not well suited for smelting in the ordinary blast furnace. For the most part these ores are magnetic and contain high percentages of undesirable elements such as titanium, phosphorus and sulphur, or are very siliceous. Magnetic separation has been tried in order to rid the ores of the greater proportion of this "gangue" and experiments along these lines are still in progress; but, so far, although technically successful results have been obtained, no very marked commercial success has been made. In many cases, even where separation has been used, it was still necessary to either briquet or nodulize the fine particles of ore, which, without this treatment, would simply be carried out of the furnace by the blast.

Since the introduction of the electric furnace into the steel industry, it has been well recognized that these Canadian ores could be smelted by electro-thermic means. In 1906, the Dominion Government issued the results of extensive investigations on the electric furnace iron and steel industry of Europe. This investigation was followed by a series of experiments at Sault Ste. Marie with a view to utilizing Canadian magnetite ores. The furnace used in these experiments was simply an enlarged pot into which dipped a vertical carbon electrode, the other terminal being made by the hearth of the furnace, which was built of a carbonaceous material as shown in Fig. 1. The charge was placed around the vertical electrode and reduction took place mainly at the lower part of the furnace, the gases resulting from the reactions escaping freely from the top. Although these experiments were technically satisfactory, yet it was seen that great improvements would have to be made in order to operate on a commercial scale. For instance, the escape of the gases from the top of the furnace represented a great heat loss. The charge also had a tendency to clog. In fact, the vertical electrode passing through the charge was seen to be impossible.

Fig. 1. Experimental electric furnace at Sault Ste. Marie, Ont.

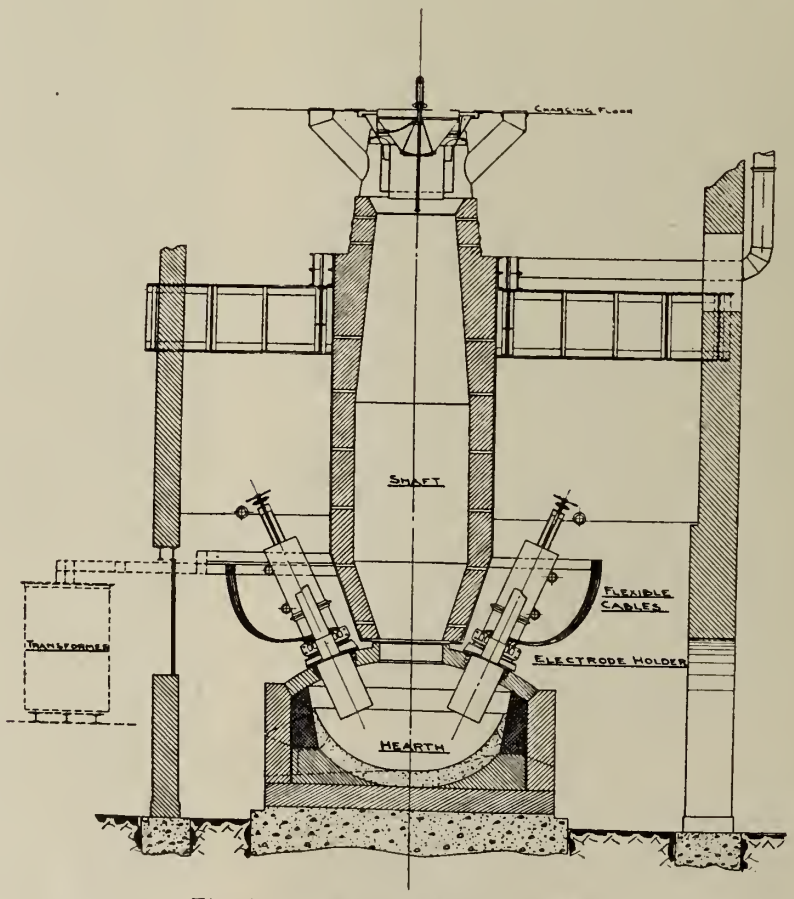


Fig. 2. A Swedish electric furnace

Since the publishing of the results of these investigations, nothing has resulted commercially in Canada; but, as a direct result of the experiments mentioned

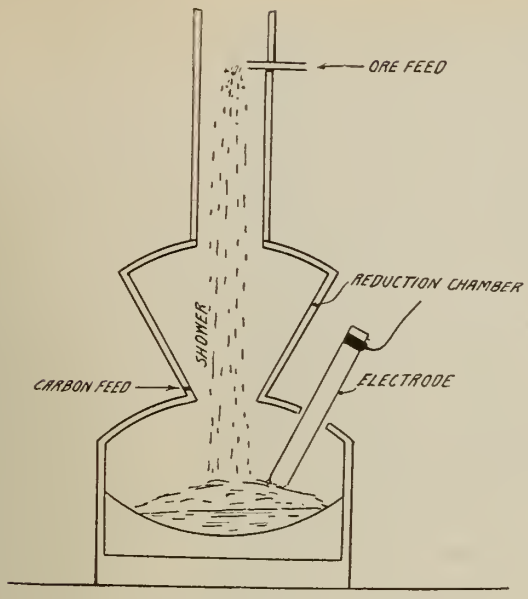


Fig. 3. Moffat-Irving electric furnace

above, a commercially successful process for the smelting of iron has been evolved in Sweden. This furnace, a cut of which is shown in Fig. 2, is a structure similar in outline to the upper part of an ordinary blast furnace, this portion being superimposed upon a crucible into which the electrodes project. This furnace was running successfully in 1911, and since then the field of operations has been very much extended.

There are, of course, many economic reasons why the electric furnace has not been more enthusiastically received in Canada in the steel industry; but, the fact that the processes require operators of experience has, perhaps, been the greatest reason why nothing has been done of any account. Those having the necessary experience are few and far between. Much investigation, however, has been independently carried on, and the new plant of the Moffat-Irving Steel Co., Toronto, is the result of such research.

The Moffat-Irving Electric Furnace.

The furnace used in this plant is diagrammatically shown in Fig. 3. Fig. 4 is a photograph of the original crucible. Fig. 5 is a view of the final furnace which, it will be seen, differs merely in detail from the original construction.

Fig. 4. The Moffat-Irving—The original crucible

Fig. 5. Moffat-Irving electric furnace—The final furnace

As indicated in Fig. 3, the ore particles are fed into the upper stack by mechanical means. The requisite limestone is also fed in at the same level. The carbon, in the form of finely ground coke, is fed into the crucible at the lower level indicated. In falling, the ore particles come in contact with a strongly reducing hot atmosphere of carbon monoxide gas and partial reduction is brought about, the final reactions taking place in the crucible of the furnace. The limestone in falling is burnt to lime by the time it has reached the crucible. This of course means the addition of carbon dioxide to the gases, and in consequence makes the reducing efficiency of the gases less; but the result has not been found to interfere seriously with the process.

It can readily be seen that fine Canadian magnetites are especially adapted for use in this form of furnace. It has been found that in many cases it is not necessary to even concentrate these ores, as the very basic slag that can be used in the electric furnace makes the handling of phosphorus and sulphur easy.

This particular furnace is 300 k.w. capacity, and is operated on three phase current. Only one electrode is shown in the cut. Actually there are three, situated at equal intervals around the furnace and dipping into the crucible at about 60 degress to the horizontal. The transformer is built to give a range of voltage from 56 to 84 volts, as required. Hand regulation of the position of the electrodes is used, there being no difficulty experienced in this respect as very even running conditions are obtained. The electrodes are 5⅛ in. graphite and pass through water coolers in the roof.

As would be expected, the metal resulting from this furnace is very sound, this, of course, being a characteristic common to all electric furnace steel. In connection with the work on the furnace, the writer has made a series of tests of the steel with the following results:

Results of Tests on Electric Furnace Steel.

		Natural Specimen.			Heat Refined.		
Heat.	Carbon.	Elastic limit.	Ultimate strength.	Per cent. Elonga'n in 2 ins.	Elastic. limit.	Ultimate. strength.	Per cent. Elonga'n in 2 ins.
167	.23	53,300	68,950	12.5	52,300	72,100	26.25
167	.18	47,500	63,900	15	46,300	66,850	25
171	.31	56,000	82,800	12.5	53,000	84,500	22.5
175	.12	49,200	53,700	17.5	47,050	57,450	35
178	.23	52,500	68,750	13.75	53,600	70,500	27.5
181	.35	53,300	84,600	10	53,950	88,400	20
184	.21	59,450	80,050	15	59,200	81,500	22.5
187	.29	49,950	74,850	15	50,500	76,650	30

The effect of heat refining is very marked, as indicated by the gain in ductility.

It is of great interest to note that the steel obtained is very fluid, which, of course, when used for steel castings, gave very clean surfaces, such as are ordinarily obtained only in grey iron castings. In fact, it was difficult to convince some users that such was not the case without actually breaking the castings and noting the ductility and fracture.

MANGANESE STEEL*

By W. S. Potter, Pittsburg, Pa.

The proportions of manganese and carbon in manganese steel are familiar to all, because manganese steel castings have been well known for a decade or more in this country. The same alloy has now become a commercial product in the wrought state, and, as not only rails and bars are rolled daily but a great variety of forged and otherwise fabricated shapes are appearing, it may be interesting to mark the progress and, perhaps, to look a little closely into the nature of this important material of engineering.

Accordingly, this paper sets forth briefly the results of a few tests and experiments and endeavors to connect the retardations, for the most part slight, observable in heating and cooling curves, with changes in microstructures seen after various heat treatments of the metal, and to correlate these with physical tests.

Retardations in Heating and Cooling.

Concerning heating and cooling curves, it should be noted at the outset that when the steel has once been so treated that it has a uniform austenitic structure, it may be heated and cooled either slowly or rapidly between, say, 0° C. and its melting temperature (ordinarily at between 1,350° C. and 1,375° C.) and the retardations observable are slight and without many repetitions. They might well be attributed to vibration or error of instruments. Specimens taken from small castings, and also rolled or forged pieces, generally show but slight retardations.

However, when the metal is first slowly frozen, and then slowly cooled—for example, at the rate of cooling prevailing in the interior of even a small mill size ingot—the retardations are much sharper and greater. As the manganese and carbon percentages are raised, the seperable constituents are increased, also by slower freezing, and cooling, the separations are increased. With greater separations the retardations are naturally greater.

The structural constituents of the series of metals from 9 to 20 p.c. manganese, and from 1 to 2 per cent. carbon (probably also of alloys considerably outside this range) are gamma iron, or austenite; cementite, a double carbide of manganese and iron; a eutectic of cementite and austenite; and what appears to be a second eutectic of lamellar structure. Structures which have the appearance of martensite, troostite, and sorbite are also found in their proper relative positions. In cooling from the liquid, gamma freezes out as excess. Next, the lamellar eutectic freezes, although it is possible that the lamellar arrangement is due to mechanical break-up slightly below the end of freezing. Lastly, the residual liquid mixture of cementite and gamma iron freezes—this eutectic is white and is usually in part, or wholly, surrounded by the lamellar eutectic, although it sometimes appears within the austenite as a nodule from which the cementite radiates. As the temperature falls below 825° there is a separation of the cementite from the austenite, giving rise to a variety of patterns, some decidedly martensitic. Troosite, and apparently sorbite, similarly result from the breaking down of the austenite as the temperature still further falls. On account of the very considerable difference in magnetic effects obtainable by cooling through, or heating in, different temperature ranges, it may be that the carbides separating in cooling at about 550° C., for instance, may not have the same composition as those separating in martensitic form at 825° C., or those separating as cementite plates at about 1,250° C. In the reheated steel during slow cooling, between 1,300° and 1,200° C., cementite separates out of the austenite as plates and needles radiating from a central nodule.

Conclusions from Heating and Cooling Curves.

The results of heatings and coolings show:

1. That there is usually a well-defined retardation between 850° and 870° C., on heating, with corresponding retardation at 850° to 825° C., on cooling.

2. That a retardation at 1,100° to 1,140° C. on heating is slight or well-defined, according to the composition of the alloy, and corresponds to a retardation on cooling at 1,125° to 1,060° C., which is equally dependent upon composition.

3. That another retardation on heating at 1,200° to 1,210° C., which is also slight or well-defined according to the analysis, may correspond to slight retardations recorded during cooling, at 1,200° to 1,170° C.

4. That the retardation due to melting occurs at 1,350° to 1,375° C., and even lower with some alloys, while the retardations due to freezing occur at 1,370° to 1,320° C., and 1,300° to 1,275° C., respectively.

5. And, finally, that slight retardations on heating were recorded at the following temperatures, in degrees C.; 350 to 375; 450 to 470; 575; 675 to 735; 975 to 1,025; and, on cooling, at the following temperatures, in degrees C.: 1,010 to 1,030; 925 to 950; 650 to 710; 525 to 550; 420 to 450; 325 to 350.

Conclusions as to the Metallography of Manganese Steel.

I present the following as fairly well proved points for further observation: In steel containing 10 to 20 per cent. manganese, 1 to 2 per cent. carbon, during cooling, gamma iron begins to freeze at about 1,370° and is for the most part frozen at about 1,270° C.; the eutectic freezes at 1,125° to 1,080° C., or perhaps a little higher temperature with low carbon and manganese mixtures; the mechanical break-up of austenite begins at 850° to 825° C.; carbides separate between the grains at 710° to 650° C.; the magnetism increases at 550° to 525° C., with further carbide separation between the grains, and there is a further mechanical separation at 430° to 420° C.

In heating, if the steel is originally austenitic, there is a preliminary break-up at 350° C.; a further break-up at 450° to 470° C.; and a complete break-up at 575° C., with separation of magnetic carbides of iron or manganese at 475° and 575° C.

In rolled steel: Separated carbides begin to be redissolved at about 725° C., and this is completed at 850° to 870° C., with re-formation of austenite.

Slight re-separation of carbides occurs along the grain outlines as the melting point of the eutectic is approached, beginning at about 1,025° C., and continuing to 1,100° C., or over. This is most noticeable in ingot metal, and taken together with the fact that the outlines of the original freezing structures persist in the cast steel at temperatures below 1,125° C. or thereabout, the remarkable tenderness of ingots between 1,025° and 1,125° C. is made clear.

In cast ingot metal: The melting of the eutectic occurs at 1,120° to 1,140° C. if heating is slow, and at about 1,100° to 1,130 C. if heating up to this point is rapid; complete resolution of constituents and re-formation of uniform austenite grains take place above 1,150° C.; cementite re-separates extensively above 1,250° C.; the mass melts at 1,350° to 1,375° C., or lower, depending on its composition.

*Extracts from a paper presented at New York Meeting A.I.M.E., February, 1914.

THE PRESENT STATUS OF OXYGEN BREATHING APPARATUS

By F. W. Gray.

A report on self-contained breathing apparatus, which has been made to the Doncaster (Yorkshire) Coal-owners' Committee on Gob Fire Research, by Dr. J. S. Haldane, has given rise to sharp comment in the editorials of the English trade papers. The editorial in one of the best known of these papers was headed "The Failure of Rescue Apparatus," a title that on mature consideration most fair-minded persons connected with coal-mining, will conclude to be a trifle spiteful. In the first place there is not, or should not, be any contrivance known as a "rescue apparatus," and if, as is the case, the reference is to self-contained oxygen breathing apparatus, it cannot truthfully be said that these devices have been a "failure."

The truth of the matter is that mining engineers on the other side of the Atlantic share the usual British dislike of grandmotherly legislation and compulsion, and a good deal of the criticism levelled against oxygen breathing apparatus has arisen from a feeling among mining engineers in Great Britain that the provisions of the Mines (Rescue and Aid) Act were impracticable and hastily conceived. Other enactments, such as the Minimum Wage Act, the Eight Hours Act, and the new Coal Mines Regulation Act, have irritated and greatly added to the worries and work of those who direct the coal-mining industry in Great Britain, and for some time past the trade papers and the presidential addresses given before the mining societies have been almost monotonously insistent on the growth of red-tapeism and restrictive legislation bearing on the working of coal mines. The response to Dr. Haldane's strictures on oxygen breathing apparatus, and the ready assent his findings have met with among colliery managers and colliery owners, is therefore, not so much caused by a feeling that breathing apparatus are a "failure," as by a feeling among those who are trying to work out this and other problems of coal-mining that the Mines Department of the British Home Office has been shown to have been guilty of hasty and ill-considered action in compelling the provision of breathing apparatus at all coal mines, and in encouraging a sympathetic, but uninformed public, to look for wholesale rescue of life at or after a large catastrophe.

Oxygen breathing apparatus has been placed in the difficult and false position of being required to live up to the reputation of a "rescue" apparatus, when really its proper function is that of an adjunct, a useful auxiliary, to the underground fire brigade. As a means of fighting underground fires at close range, the usefulness of oxygen breathing apparatus should surely by this time be unquestioned. It would be difficult to name a coalfield of any importance, where they have not been so employed with advantage, and they have also been found very useful in metal, ironstone and sulphur mines.

It is too soon to say that oxygen apparatus is a "failure." If Dr. Haldane's report proves anything it is that these devices are capable of improvement, and are in process of evolution through the processes of trial and experience. The fact that the Doncaster Coal-owners' Committee propose to ask Dr. Haldane to make a further test at the end of three months, in order to see if the apparatus on the market at that time has been improved, is in itself sufficient proof that the Committee do not consider the objections raised as being fatal, or that the present apparatus on the market cannot be raised to the required standard.

Much has been said of the number of lives lost through wearing breathing apparatus, and it is right that this point should not be glossed over. Some of these deaths have revealed unsuspected possibilities of danger in the use of breathing apparatus, but some others have resulted from the use of defective apparatus.

The men who have used breathing apparatus, have, like the apparatus itself, suffered from the false perspective in which they have been placed. In compelling the provision of breathing apparatus, and the training of men in its use, the Home Office do not seem to have considered that men who take training thereby single themselves out for dangerous duties, and lay themselves open to the unjust imputation of cowardice, if they should refuse for the best of reasons to undertake impossible tasks of rescue when the time of testing arrives. It says a great deal for the courage and heroism of miners, that they have not hesitated to avail themselves of the help that breathing apparatus has afforded, and it may be pointed out that the work of rescue after mine disasters, with or without the aids of modern invention, has always, and always will, take death toll of brave men, who are prepared to risk anything to save their comrades. And for this very reason a sharp distinction must always be drawn between the use of breathing apparatus in the minor accidents of a mine, such as accumulations of gas, fires and other temporary derangements in which breathing apparatus are useful, and their use after great disasters.

Dr. Haldane states that his experience has not been sufficient to say, "How much difficulty is found in keeping each apparatus fit for use and applying the necessary tests, or to what extent proper precautions are actually taken." This is probably the most important point in connection with the use of breathing apparatus. Although Dr. Haldane is very impartial in pointing out serious defects in every single type of breathing apparatus on the market, and although several men have lost their lives when wearing these devices, a good many instances could be given of the actual use of breathing apparatus for very long periods, under exacting conditions, without any such happenings, and there can be no question that several of the apparatus on the market, when in good order and used by experienced men, will enable the safe performance of strenuous labor in an irrespirable atmosphere, and have done so on very many authenticated occasions. But apparatus must be in good order. No amount of ingenuity or skill in devising a flawless and physiologically perfect apparatus will prevent accidents, if these apparatus are not kept in good order and tested before use. In an article that appeared in this journal shortly before Dr. Haldane's findings were made public, the writer likened the wearer of a breathing apparatus to an aviator and suggested that equal care in testing and inspection was necessary in

the use of breathing apparatus under dangerous conditions as in the use of an aeroplane. Dr. Haldane uses the same illustration, and remarks: "Liability to failure of some essential part of a rescue apparatus would, in fact, be nearly as dangerous as similar liability to failure in an aeroplane."

It must also be remembered that the sole object of breathing apparatus is to enable men to live and work in an irrespirable atmosphere, such as exists under certain conditions in mines, more particularly coal mines. The apparatus worn for this purpose is no protection against the other dangers of the mine, and it will not enable a man to penetrate where it would be difficult, in a pure atmosphere, for an unencumbered man to penetrate.

The condition of the underground workings of a coal mine after an explosion is usually much disturbed, the interruption very often occurring at some important junction or entrance, fire is often present, and in all the recent great coal mine explosions, the death of those underground seems to have been simultaneous with the blast, or to have occurred very shortly after. It is unfortunately only too true that the prospect of rescuing any great number of men after an explosion in a modern coal mine, is of the slimest description, and the work of the apparatus men is usually the melancholy one of bringing out the dead. The sooner the public mind is disabused of the idea that breathing apparatus add to the safety of a mine, or will enable the performance of miracles in rescuing men, the better. The function of these apparatus will then be seen in the true perspective, and they will be valued for what they are, namely first, a useful auxiliary in circumstances that occasionally arise in a coal mine, more particularly in fighting and sealing off mine fires; and second, for assisting in the restoration of ventilation, the advance exploration, and the removal of the dead after a mine explosion.

With these objects in view, by experience and candid scientific investigation such as that undertaken by Dr. Haldane, there can be little doubt that the evolution of the breathing apparatus will proceed from good to better, as it has done in the past. In the meantime, it might be suggested to makers of these apparatus that a little less "knocking" of the other fellow's device, and attention to some of the defects pointed out by Dr. Haldane's report would be well received by those who have to believe or disbelieve the irreconcilable statements of rival makers.

N. S. STEEL AND COAL.

Profits of the Nova Scotia Steel and Coal Co. showed considerable improvement in 1913 over 1912. The year's income of $1,255,953 represents a gain of $255,944 over the previous year. Earnings, after meeting all fixed charges, and providing for depreciation and betterments, were equal to 7.80 per cent. on the outstanding $6,000,000 of common stock. This compares with a net of 5.67 earned in 1912, when, however, it will be remembered the company suffered materially from American "dumping."

After meeting all charges, which showed an increase due to the issue during 1913 of $2,000,000 debenture stock, the company carried forward $75,286 out of the year's earnings. This together with the balance at December 31, 1912, of $452,600 brings the total amount carried forward to $527,886.

Profit and Loss.

The profit and loss figures of the past three years make the following comparison:

	1913.	1912.	1911.
Profits	$1,235,953	$1,000,609	$1,019,392
Less—			
Bond interest	395,576	352,311	291,168
Debenture interest	109,559	60,000	60,000
Sinking fund	32,659	26,105	24,800
Depreciation Reserve	70,185	92,196	96,124
Written off	107,682	61,009	73,880
Directors	12,500	12,500	12,500
Insurance fund	10,104	10,032	10,576
Total	$738,267	$614,153	$569,048
Balance before div.	517,686	368,456	450,344
Less—			
Preferred dividend	82,400	82,400	82,400
Common dividend	360,000	360,000	360,000
Total dividend	$442,400	$442,400	$442,400
Net balance	75,286	*55,944	7,941
Previous balance	452,600	508,544	500,603
Total balance	$527,886	452,600	$508,544

*Deficit.

General Manager's Report.

In a report placed before the directors at a meeting in Montreal, Thomas Cantley, general manager, stated that 1913 had opened with great promise. Demand for the company's products during the early part of the year had been good. During this period a large tonnage was booked at fair prices, sufficient to keep the mills fully employed until the closing weeks of the year, the result being that the outputs of iron ore, pig iron, steel ingots, billets, bars and forgings all showed substantial increases over previous years.

Referring to the Wabana iron ore property the report stated that the company's holdings under title from the Crown now covered 91 square miles, and that the submarine development had been extended by the opening up of 9,751 linear feet of levels, crosscuts, headways and rooms, and the ore won from this section of the property was over 40 per cent. greater than that of the previous year. The general manager also reported that good progress had been made in the sinking of the new Jubilee shaft, which would be equipped by 1915 for an output of 1,500 tons per day. A new open-hearth steel furnace was completed during the summer, and a number of improvements to plant and equipment had been carried out.

Perhaps the one point lacking in the very excellent report returned by Mr. Cantley and the directors in preparation for the shareholders' meeting is that no indication is given of the possibilities for 1914. No forecast appears with regard to the outlook for business as viewed by the directors. The company is seen to be in a very strong financial position, but at a time when so many vague and not altogether favorable reports are heard on the "street" with regard to the steel industry, it would be interesting and no doubt more reassuring to hear how the directors regard the possibilities for business in the coming months. Possibly the shareholders will hear something of 1914's prospects at the annual meeting, which takes place in March.—Financial Times, Montreal.

PLACER MINING IN THE KLONDIKE*

By D. D. Cairnes.

In a few localities, as on Quartz creek, along the lower portion of Sulphur creek, and on a few outlying creeks, private parties are working their properties with small outfits, and there, the old-time methods, formerly so extensively employed are still to be seen. Throughout the greater part of the district, however, the placer deposits are owned and operated by large companies or corporations who work their holdings on an extensive scale. The larger companies are the Yukon Gold Company, Boyle's Concession Limited, and a company controlled by Mr. A. N. C. Treadgold. These companies control the bulk of the placer property in Klondike district, and in attempting to give a general description of the placer mining operations in Klondike district, possibly the best and simplest manner of so doing will be to describe briefly the installation and work of each of these companies.

In mining in this district many changes were necessarily introduced in adapting to the frozen gravels of Yukon the placer mining methods previously understood and employed in California and other temperate climates. The dredges had to be strongly built in order to withstand the severe service of digging the broken schists which compose the bedrock, and the frozen gravel which is almost impenetrable as granite. Probably the most serious problem, however, was to overcome the frozen condition so that the material could be handled as readily as similar ground in California or elsewhere. These matters are of intense interest to the mining engineer.

The Yukon Gold Company.

The Yukon Gold Company owns practically all the more important gravels on Bonanza, Eldorado and Hunker creeks and their tributaries, the holdings of the company being mainly included in an area about 25 miles in diameter.

The operations of the Yukon Gold Company in Klondike district are in general, limited to two phases of placer mining, viz., dredging and hydraulicking. The gravels in the valley bottoms are all dredged, but those higher up on the hills and sidehills, which cannot be conveniently reached by the dredges, are hydraulicked, and in general the lower deposits are first worked so as to afford tailings ground when working the higher gravels. During the season of 1912 an average of about 600 men were employed by this company, 400 of whom were engaged in connection with dredging, about 130 on the hydraulic properties and ditches supplying these with water, and the rest were employed mainly in the machine shops, power plant and stables.

Dredging.

The Yukon Gold Company has built and is operating eight dredges, as follows:—Three Bucyrus 5-foot boats, one Marion 7-foot boat, four Bucyrus 7-foot boats.

The 5-foot and 7-foot boats have buckets with a capacity of 5 and 7 cubic feet respectively. All are electrically driven elevated, close-connected bucket-line dredges of the revolving screen and stacker type. Two of the boats, numbers 8 and 9, which were built during 1911, have hulls constructed entirely of steel.

The dredging season opens about May 1st and the dredges can operate from then until some time between October 15th and November 1st, an average of about 175 days each year.

The capacity of the dredges on the creeks in which they are working, has proved to be about 100,000 and 120,000 cubic yards per month for the 5-foot and 7-foot boats respectively. The area they cover depends largely on the depth of the ground in which they are working. During 1912, however, the 5-foot boats covered, on an average, about 12,000 square yards, and the 7-foot boats an average of about 16,500 square yards per month. The dredges run day and night, and shut down only for repairs or to clean up, the latter being necessary about every 3 to 9 days.

The ground to be dredged is all previously thawed. In some areas, as in the neighborhood of a creek, or where the moss has in some way become stripped off the surface, the ground has become naturally thawed. In places, also, the gravels have been thawed during former mining operations, but the greater part of the ground is thawed by steam just previous to dredging. Long, hollow, perforated steel tubes with sharpened points are driven into the ground, and steam is forced through these and into the surrounding frozen ground.

The dredges take up, in addition to the gravels and overburden, the underlying bed rock to a depth of 3 to 9 feet.

The Giant Ditch.

In connection with the hydraulic operations of the Yukon Gold Company, one of the greatest problems was that of obtaining sufficient water to work the properties. To obtain this water a giant ditch system has been constructed and a storage dam built.

The storage dam, situated on Upper Bonanza creek, is 68 feet high at the crest, 205 feet wide at the base, and 465 feet long at the top, with an impounding capacity of 54,000,000 gallons.

The main ditch conveys water from Little Twelvemile river to the creeks of the Klondike district. The main ditch system consists of 64.2 miles of main line, composed of 15 miles of flume, 37 miles of ditch, and 12 miles of pipe line, crossing five depressions and delivering water to the Lower Bonanza hills under a head of 500 feet. The capacity of the main ditch is 5,000 miner's inches. The Bonanza Extension is approximately 6 miles in length, has a capacity of 3,000 miner's inches and crosses three depressions. The total length of the ditch system and extensions is 75.2 miles.

Practically the entire construction work of the Yukon Gold Company, including the ditch system, was completed in three seasons of four months each, or a little over one year of actual construction work. Considering the unusual difficulties to be overcome, this work may be justly called an engineering triumph. The Klondike syphon—the huge pipe line which carries the water across the valley of the Klondike—was itself an undertaking of considerable magnitude. Mr. T. A. Rickard in his description of this ditch system writes: "The country traversed by this ditch is a rolling woodland indented by the alluvial flats of the Klondike, the Twelvemile, and other streams flowing into the Yukon

*Extract from guide book No. 10, prepared for the 12th session International Geological Congress, by the Geological Survey, Canada.

river. As seen from a height, the wilderness stretches unbroken from the meandering shimmer of the Klondike, enclosed within high banks on which white scars mark bench-diggings, to the Ogilvie range, where, far to the north, the snow still lingers in token of the gift of water that shall enable man to win the gold from the deposits of gravel strewing the tortuous valleys."

In preparing to build the ditch, the first step was to place a sawmill on Twelvemile river, and thus to obtain the lumber for construction. Then an electric generating plant was erected and the wires were strung on poles for 36 miles, transmitting power from Little Twelvemile river to Bonanza creek. While this was being done, surveys for the ditch were hastened; and as soon as these were completed, the right-of-way was cleared. The small growth of forest was removed, and the moss stripped from the frozen ground for a width of 22 yards. Steam shovels were then put to work, and while the ditch was being dug, the sawmill on the Twelvemile yielded the lumber needed for the construction of the flume and for other purposes. Seven million feet (board measure) of lumber was cut; this depleted the small forest in the vicinity, but it proved sufficient.

In connection with building the ditch, "roads of the corduroy type have been constructed, moss being laid on the poles and dirt on the moss. The trails traverse the brush in straight lines. Horses and men, steam and muscle, have fought against the wilderness and subdued it. The big ditch looks like a Panama canal, and the steam-shovels gnawing and digging in the deep cuts recall pictures of Culebra. Many of the laborers had worked on the Isthmian canal, and assuredly the young engineers were as proud of the work they were accomplishing as if it were a national or even an international enterprise."

About 14 hydraulic properties were operated in 1912 on the different hills and gulches along Bonanza and Hunker creeks, the majority of these being on Bonanza creek below Grand Forks. These hydraulic properties are equipped with auxiliary pipe lines from the main water system, gates, tunnels, cuts, sluiceways, and giants from which the streams of water are driven with a pressure of upward of 100 pounds to the inch, and strike the banks with a roar that can be heard for miles.

The company's hydro-electric power plant is operated by water from Little Twelvemile river carried through 5 miles of flume and delivered to the plant under 650 feet net effective head. The installation consists of three 650 K.W. generators, direct connected to the three water wheels of the impulse type. The main transmission here is 36 miles in length, operating at 35,000 volts with 18.2 miles of extensions and secondaries.

Boyle Concession, Limited.

The Boyle Concession, Limited, has taken over the holdings of the Canadian Klondike Mining Company; controls and operates the properties of the Bonanza Basin Gold Dredging Co.; and operates the plant of the Granville Power Company.

The holdings of the Boyle Concession, Limited, include the Boyle Concession, about 4 miles of the creek bed of Allgold creek, and 4 miles of the creek bottom of Flat creek. The Boyle Concession comprises 6.7 miles of the valley of Klondike river to the summits on either side, also Bear creek and its hillsides, and the Klondike river slope of Lovitt hill; in all about 40 square miles. The holdings of the Bonanza Basin Gold Dredging Co. include about 50 placer claims in a group at the lower end of Klondike River valley and just below the Boyle Concession; nearly all Last Chance creek with adjoining hillsides; part of Dago hill; a number of placer claims on the upper end of Hunker creek; and some placer claims on Upper Eldorado.

The operations of the Boyle Concession, Limited, are confined at present to dredging. Two dredges were in operation in 1912, and two more were being built.

No. 1 dredge is an electrically driven boat, with a close-connected bucket-line of 68 buckets, each having a capacity of 7½ cubic feet. This dredge has a total motor capacity of 350 horsepower and has been operating continuously each season since 1905. No. 2 dredge is an electrically driven boat with close-connected bucket-line of 68 buckets, each having a capacity of 16.1 cubic feet. This dredge has a total motor capacity of 1005 horsepower, and started operating in 1910 and has since operated continuously during the dredging seasons.

These two dredges are both operating in the valley of the Klondike on the Boyle Concession.

The two dredges being erected will be very similar to No. 2, but will have slightly larger hulls and will be equipped with some new features for protection in operating during severe weather. Each boat contains over 1,000 tons of machinery and required 612,000 feet of lumber in the building. These are being erected on the property of the Bonanza Basin Gold Dredging Co., below the Boyle Concession.

The Boyle Concession, Limited, has a machine shop capable of making all repairs at the mouth of Bear creek, and also owns three 35-ton steam shovels with hauling equipment, and other machinery.

The Granville Power Company has a 10,000 horsepower hydro-electric power plant situated in the valley of Klondike river near the mouth of the North fork. The water is taken from the North fork of Klondike river through 6 miles of ditch having a capacity of 15,000 to 20,000 miner's inches, and is supplied to two turbines through two pipes with an effective head of 228 feet.

The power plant consists of two units, and includes two I. P. Morris 5,000 horsepower wheels of the reactionary type, two alternating current generators and two exciters built by Westinghouse Electric Manufacturing Co. The power is generated at 2,200 volts and stepped up at plant to 33,000 volts, and is carried over two main distributing lines, one down Klondike river to its mouth, and the other across the divide to the Indian River watershed.

This plant ran until December 21st, 1911, and the company hopes to be able to instal devices enabling them to operate throughout the entire winter.

Treadgold Property.

A company managed by Mr. A. N. C. Treadgold holds extensive interests mainly on the Indian river side of the divide. This company controls practically all Dominion creek; has interests on Sulphur creek; controls most of Quartz creek and Indian river below Quartz creek; and also has a few claims on the upper end of Eldorado creek. During 1912 the operations of this company were mainly confined to Dominion creek, where they did only preliminary work. This consisted mainly in removing the overburden by ground sluicing and so preparing the ground for future development.

Placer Gold Production of the Yukon.

The placer gold production of the Yukon from 1897 is as follows:—

1898	$10,000,000
1899	16,000,000
1900	22,275,000
1901	18,000,000
1902	14,500,000
1903	12,250,000
1904	10,500,000
1905	7,876,000
1906	5,600,000
1907	3,150,000
1908	3,600,000
1909	3,960,000
1910	4,550,000
1911	4,580,000
1912	5,540,000

The low production during 1907, 1908 and 1909, was due mainly to the fact that at that period placer mining was undergoing a transition from the old to the new methods. The Yukon Gold Company had acquired most of the ground that had formerly been the most productive, and were devoting their energies to installing their new equipment rather than to mining.

The figures given above are for the entire Yukon Territory, but the gold production from points outside of the Klondike has probably never exceeded $100,000 per year.

BRITISH COLUMBIA COPPER CO.

The following information relative to the British Columbia Copper Co., Ltd., has been printed in Western Canadian newspapers and other publications:

Official announcement received from New York states that Hayden & Stone, Boston and New York bankers, have consented to underwrite the proposed $1,000,000 bond issue of the British Columbia Copper Co., and as a result the stock jumped to $4.00 a share on the eastern exchanges, an advance of $2.00 in ten days. The company is to be reorganized under terms agreed upon by present stockholders, who assert that the conditions imposed are not fair and equitable, but such that the company will be enabled to consummate the plans for expansion and development it has had under consideration for years.

"As for its Mother Lode and other mines British Columbia Copper Co. has been operating at a profit for many years," says the report. "These have been steady income producers, but, unfortunately, the earnings have been expended the last two years in acquiring and exploring a number of new properties in Washington and British Columbia. In the last 18 months the company has spent approximately $550,000 in purchasing and developing new holdings. In the last two years the net earnings have been not to exceed $700,000, and it can be seen readily that this campaign of expansion entailed a heavier financial burden than the company could carry conveniently, in view of its limited resources, and the result was the depreciation of its stock from $8 a share a few years ago to a low level of $2.

Will be Reorganized.

"Hayden, Stone & Co. have underwritten a proposed bond issue of $1,000,000 in convertible 6 per cent. debentures. The matter of issuing these bonds, as well as other detail of refinancing the company, will be submitted to stockholders, and afterward a special meeting will be called, when the proposals doubtless will be ratified."

While the proposed plans have not yet been given out, it is learned that the British Columbia Copper Co., now capitalized at $3,000,000, will be reorganized into a $5,000,000 company. Of the 1,100,000 shares of new stock, par $5,600,000 shares will be set aside to arrange for exchange, share for share at par, of the present stock for the new stock. Two hundred thousand shares of the new stock, of the value of $1,000,000, will be placed in the treasury as a reserve against conversion of the $1,000,000 of 6 per cent. convertible bonds to be issued. It is inferred that the remaining 200,000 shares of the new stock, left in the treasury, will be used or sold for company purposes in acquiring, developing and equipping new properties. As a matter of fact, the present outstanding shares of British Columbia Copper Co. total only 591,709, instead of the authorized 600,000, so that under the scheme of reorganization there will remain "treasury stock" amounting to 208,291 shares of the par value of $5 each, instead of 200,000 shares.

New Properties.

The principal new properties to be taken over by the British Columbia Copper Co. are the Princess group, of between 40 and 50 claims, situated on the flanks of Copper mountain, in Voigt's camp, Similkameen, British Columbia. Thirteen of these claims had been taken up by the company in 1912. The ore already blocked out in this tract is 4,000,000 tons of ore, averaging 1.87 per cent. copper, and there is estimated to be 4,000,000 tons of probable ore not yet blocked out. The ores carry 60 cents a ton in gold and silver. It is proposed to erect a concentrator to handle the product from the Copper Mountain group, but the main smelter of the company at Greenwood, Boundary district, British Columbia, will smelt the concentrates. The company's engineers have already selected a power site, which will be used to develop hydro-electric power in connection with the new mines. This power site is on Whipsaw creek, a tributary of Similkameen river, opposite Copper mountain, and about 10 miles from Princeton.

Mines in Washington.

Another property of the British Columbia Copper Co. which is giving considerable satisfaction is the Lone Star and Washington group, just across the International boundary line, and about eight miles south of the company's smeltery at Greenwood. Nearly 500,000 tons of ore have been developed within less than 10 per cent. of the Lone Star ground in the last few years, and further development is now in progress. The ore is of a somewhat refractory nature, and a concentrating plant has been installed near the Dominion Copper Co.'s works at Boundary Falls, three miles from the British Columbia Copper Co.'s plant at Greenwood. At this concentrator the refractory constituents of the ore will be eliminated. A five-and-a-half-mile aerial cableway connects the Lone Star mine, running cross country to the concentrator.

Another property taken under option by the British Columbia Copper Co. is the Eureka group of claims near Nelson. The third payment on the option for this group was made several months ago. The company also recently put men at work on its properties in Wellington camp, purchased in 1909.

COMPARISON OF MINING CONDITIONS IN THE UNITED STATES TO-DAY WITH THOSE OF 1872*

By R. W. Raymond.

The Situation in 1872, from the standpoint of the prospector, the locator, the possessory claimant, and the patentee of mineral land under Federal statutes, cannot be understood without a knowledge of the situation prior to 1866, and between 1866 and 1872.

The Situation Before 1866.

The western public domain acquired by the United States through treaties, as the result of conquest or purchase, was invaded after Marshall's re-discovery of gold in California, by an overwhelming multitude of prospectors and miners from all parts of the world. The mineral lands of the whole Pacific slope were practically unsurveyed. Congress, disgusted with the experiment of leasing mineral lands, which it had tried for 40 years, and abandoned in 1847, enacted no laws for the management of these public mineral lands, and the pioneers made their own laws governing mining titles. These local regulations applied at first to gulch-mining in the auriferous river beds only; and they constituted a simple and practical system, adapted to the needs and means of primitive communities—significantly called "camps." They had the means of measuring distances, but not angles; they knew no property except personal property in the form of pick-axes, pans, supplies, camp-equipage, horses or mules, and mining rights. The earliest codes which they developed expressed what might be called the law of the lariat. With the lariat they measured the distance assigned to each miner along the gold-bearing gulch—a double portion to the discoverer, and a single portion to his successors, in the order of their coming. With the lariat, they hung, after such due process of law as was available, the rascal who stole a horse, or a bag of gold-dust, or a mining claim, or killed another man without giving him fair notice and a chance to defend himself. In these pioneer codes, adopted in mass-meetings and enforced by the same authority, two features concern us most:

1. They measured mining property by one dimension only. So many feet of the gulch, held by one man, meant a distance into either bank, and a distance in depth, extending as far as gold might be found.

2. Priority of right (and usually double extent of longitudinal dimension) was given to the discoverer, and, after him to locators, in the order of location.

This system of mining titles ignored altogether the superior rights of the United States as owner of the land. As I have elsewhere shown,† this difficulty was solved by the common sense of the courts, which adjudicated controversies between trespassers on the public domain, according to their relative rights under local regulations, and subject to any future assertion of the higher rights of the United States.

Meanwhile, in many districts, the discovery of metal-bearing veins had inaugurated the new industry of "quartz-mining," and the pioneers simply applied to these deposits the rule already adopted for gold-bearing gulches: namely, they treated a vein as if it were a gulch; granted mining claims upon it, measured by a single dimension, and included in each claim all "dips, spurs and angles," i.e., all valuable mineral branching from the main vein between the two ends of the claim.

The Situation Between 1866 and 1872.

The Act of 1866 was an attempt to legalize the conditions which had thus grown up in the absence of Federal legislation. It declared the public mineral lands open to occupation and exploration, thus removing the guilt of trespass from prospectors and miners, and permitting for an indefinite period the exploitation of such lands, under the local regulations of the mining camps of the States or Territories in which they were situated. This confirmed the prior right of the discovery, which was the basis of all such local regulations. Moreover, the Act adopted the "law of the lariat, "that is, the measurement of mining claims by one longitudinal dimension, and the possessory title of the locator to "dips, spurs and angles." Finally, it provided for the purchase of permanent rights by patents from the United States, including certain rights within a given area of surface, required for mining operations on the vein located. This area was to be defined before the grant of the patent.

But unfortunately the Act of 1866 did not grant to locator or patentee any exclusive possession of the surface thus located, but only an "easement," or prior right of use. I believe that this feature of the Act, like the rest of it, was simply intended to legalize existing mining conditions, especially at Virginia City, Nev., which was, in 1866, the most productive locality of "quartz-mining" in the West. The towns of Virginia City and Gold Hill were situated on and along the outcrop of what came to be known afterward as the great Comstock lode, though separate mines were then operated upon what were asserted to be separate lodes. The valuable buildings and building-lots of these towns would have been included in any grant of the surface to the mine-owners; and the Act was so drawn as to give the mine-owners only a sort of right of eminent domain, by virtue of which they could occupy such ground as they needed for mining purposes. Whoever saw the Comstock mines of that period, must remember the amazing complex of dumps, ore-bins, roads, shaft-houses, derricks and whims, interspersed with hotels, saloons, offices, stores and residences, exhibited at Virginia City.

But in the other mining districts which were soon discovered and developed, with a sanguine enthusiasm kindled by the wonderful bonanzas of the Comstock, the mere "easement" granted to the surface of a mining location was soon found to be an unsatisfactory protection to the locator. One of the most important of these districts—and the one which, I think, had most influence in bringing about the Act of 1872—was that of Reese river, in Nevada, which was characterized by numerous sharply defined, narrow, frequently faulted fissure-veins, carrying very rich silver-ores, such as horn-silver, ruby-silver, etc. The locator upon such a vein had hard work, at best, to prove its identity in depth, beyond a fault which had cut it off, and thrown it to one side or the other. And he could not prevent other adventurers from starting shafts or tunnels in his neighborhood, and claiming as their own any bunch of rich ore that they might find. His only way to establish ownership was to push his own work underground until he reached the workings of such alleged

* Presented at New York Meeting A.I.M.E., 1914.
† National Resources and Our Federal Government, Trans., xliv. 617 et seq. (1912).

discoverers, and then prove a practical continuity of ore from his prior location on the vein. Until that was proved, the hostile adventurers were not trespassers; they were simply exploring the public domain. And after it was proved, perhaps at great expense, he could rarely recover damages for the ore "innocently" taken by them. A writ of ejectment, expelling them from the stopes they had, perhaps, exhausted during the litigation, might be the only fruit of his victory.

This situation, promoting the practice of deliberate robbery in the immediate vicinity of every rich ore body, was, of course, intolerable; and it is not surprising that the Federal court in Lander county, Nev., rendered a decision, so construing the Act of 1866 as to make it authorize a lode-locator to exclude prospectors from the surface of his location. John H. Boalt, the judge who made that decision, was a mining engineer as well as a lawyer, and afterward became one of the leaders of the San Francisco bar. His opinion was acute and forcible. Undoubtedly the Act ought to have meant what he construed it to mean. But his view was overruled by higher authority, though his arguments doubtless had their weight in bringing about the change inaugurated by the Act of 1872.

It is noteworthy that the Act of 1866 did not provide for placer-mining rights, or patents to placer-claims, although this was the earliest mining industry upon the public domain. The reason was that no special difficulty had arisen as to such mining titles. The general permission to explore and occupy the public mineral lands, subject to local regulations, was enough, at that time, to satisfy that class of miners. But in 1870 an Act was passed amending and supplementing that of 1866, by providing that claims usually called placers, "including all forms of deposit except veins of quartz or other rock in place," should be subject to entry and patent. This had two important results: (1) It made placer-claims patentable, as they had not previously been; and (2) it included with placer-claims all deposits not "lodes," and included (as construed subsequently by the courts) other minerals than "gold, cinnabar, silver, or copper" specified in the original Act. There is reason to believe that both of these features, though desirable in themselves, were secured in furtherance of private enterprises—especially that of the so-called "diamond swindle," which was exposed in 1872. At least, I remember that the Act of 1870 formed part of the basis upon which this scheme was presented to New York capitalists.

The Act of 1872 was intended chiefly to remedy the above-mentioned defect in that of 1866, by granting ownership of the surface to a lode-locator. Its authors thought they were grafting a new feature upon the result of long years of growth; but they were, in fact, planting a new root altogether. The Act of 1872 was revolutionary. It made the mining right an appurtenance to the surface location, instead of granting an easement in the surface as an appurtenance of the mining right; for the reward of the discoverer it substituted the luck of the apex-possessor; and the title conveyed under it was subject to doubt and possible defeat as the consequence of new geological discoveries so long as the mining ground which it was supposed to cover might continue to be worked.

The extralateral right, supposed to be simply continued by the Act as a legacy from "the law of the lariat," suffered a considerable change through its dependence upon a new condition—the apex—which might or might not be correctly determinable at the time of location. This sudden introduction of a totally new basis of title led me to call the Act of 1872 "the law of the apex," a name which was universally adopted, together with that of "extralateral right," which I gave to the ownership of certain underground portions of a vein not vertically beneath its surface location. (The term "extralateral" could not have been applied under the Act of 1866, which attached no significance to the shape or position of the location as defining the mining right to which it was a mere appurtenance.) Without going into further details as to the features of either Act, it may be said that both of them were dictated by the desire to respect as far as practicable the customs and self-made rules of miners upon the public domain; and that such changes as were made were intended to meet existing conditions and satisfy the demands of influential constituencies and industries. It is impossible to explain by reference to the provisions of pre-existing European or Spanish-American codes the peculiar features of these statutes. They grew up out of local conditions, and were formulated by men ignorant of precedents and principles. Moreover, even those men were necessarily "opportunists," taking more or less blindly one step at a time. They never had a chance to frame a mineral-land law de novo. From the beginning, they were trying to satisfy the mining communities, and recognize as far as practicable existing local customs, remembering always that any attempt at sudden and essential change of such customs would be ridiculously futile, because incapable of effective enforcement. And of the revolutionary change which was thus made in several respects by the Act of 1872, both the authors of that measure and the communities affected by it were sublimely unconscious.

The foregoing demonstration of the "opportunist" character of Federal land legislation warrants the inquiry whether the conditions of 1872 have since been so changed as to justify new legislation in 1914.

The Situation in 1872.

As I have said, the potential mischief continued in the Act of 1872 was neither foreseen nor immediately realized. The statute was welcomed in the region to which it applied as a much-needed protection to bona fide prospectors and their grantees, the investors of capital. No one expected it to produce a harvest of blackmail and litigation. Its immediate effect was to encourage the adventurous and speculative exploration of one new district after another; and, as the pioneer industry of mining blazed the way for the advance of all other civilized activities (though too often at ruinous cost to itself), the result was the conquest of a vast wilderness, and the creation of a new empire.

The situation in 1872 was this:

1. Indian wars had been practically removed as a serious element of danger, preventing the exploration of the public domain. Their doom was pronounced when the completion of the first transcontinental railway permitted the rapid movement of troops and supplies, so that hostile tribes could be pursued in winter campaigns.

2. Successive discoveries of rich placer or "quartz-mines" were causing excited stampedes of mining prospectors.

3. The price received for silver was such as to encourage silver-mining; and the silver-bearing deposits of such districts as the Cottonwood Canons in Utah, White Pine and Eureka in Nevada, Owyhee in Idaho, etc., were being developed with wild enthusiasm. As we all know, certain classes of silver-bearing deposits offer outcrops of very rich minerals, admirably adapted to stimulate speculation. And the outcrops of silver-lead ores (already utilized in Utah, and soon to assume

at Eureka, Nev., and at Leadville, Colo., immense economic importance) furnished, in their combination of lead, silver and iron oxide, a material "smelting like butter" in the primitive furnaces of the period.

I am not here concerned with the exact dates of successive discoveries and developments in different regions, or successive advances in the mining and metallurgical industry of the West. My own public reports as U. S. Commissioner of Mining, etc., from 1868 to 1876, and many other authorities, may be consulted as to these details. What I wish to emphasize here is the character of the period just before and just after 1872, as one of the new discoveries, new districts, new processes," the exploitation of "bonanzas," and the enormous development of speculative investments in mining enterprises on the Pacific slope. It cannot be denied that the Act of 1872, with all its defects, stimulated this amazing continental development. Carlyle describes the tactics of the armies of the French Revolution as a process of "swarming"—a word which includes, in the German language from which he took it, the element of enthusiasm. The wilderness of our West was similarly overrun by the irresistible "swarming" advance of our mining pioneers, under the stimulus furnished, and in spite of the hindrances imposed (as we can now clearly recognize), by the Act of 1872.

The Present Situation.

The conditions of to-day are the cumulative result of causes operating since 1872, among which the following may be named as the most important:

1. The demonetization of silver and its consequent fall in price. This naturally discouraged speculation in silver-mining, while it promoted economy in mining, handling, and reducing silver-bearing as well as other ores.

2. With the gradual exhaustion of rich bonanzas, the exploitation of large bodies of complex, low-grade ores had many important results.

a. It was both cause and effect of the improvements in the methods and machinery of mining, transportation and metallurgy, mentioned above.

b. It employed larger numbers of men for longer periods, thereby creating greater and more permanent communities, and more numerous and varied industries, trades and institutions. The general working of low-grade ores laid the safe foundation of civilization and progress in the new empire.

c. It brought into profitable use the baser metals, which are more essential to human industry than the so-called precious ones. Yet this development of enterprises in which gold and silver were technically by-products really increased the production of those metals. It is both instructive and amusing to read the utterances of the prophets of the last quarter of the nineteenth century, concerning the future of gold and silver. Our wise predictions were nullified, not so much by the discoveries of new producing districts, as by the new experimental illustration of the old, old general truths, that the existence of a bonanza of very rich ore may, and generally does, indicate the presence of a much larger amount of low-grade stuff, which, being temporarily too poor to "pay," is either not mined at all, or rejected after mining; that the "barren ground" and the waste-dumps of one period may be the mines of the next; and that he who, by utilizing neglected constituents, or reducing costs of mining, etc., enlarges the class of "workable" ores in an old district, may have performed a service equivalent to the discovery of many new ones.

d. This wonderful advance in the exploitation of low-grade ores inevitably diminished to some extent the importance of the old-fashioned "prospector," whose business was to find outcrops, make small surface developments, and sell out to promoters, on the basis of sample-assays. Investors no longer cared so much for " rich" assays; they wanted large masses of low-grade, and a secure title, neither of which the ordinary prospector could guarantee. He become, consequently, more and more a mere scout, whose first discovery was only a call for further investigation by geologists, lawyers, practical engineers, etc., before even the promoter, to say nothing of the actual investor, would take up in earnest the proposed adventure. Moreover, the great mining concerns employed their own scouts, and the old-fashioned prospector, operating on his own account, was almost left out of the new system. He has now well-nigh passed away, as have passed many other free-lances of the vanguard of progress. We may sympathize with him, but he had to go!

3. Legal conditions likewise have been profoundly affected by industrial progress. The ore deposits of greatest importance were very different from the comparatively narrow and well-defined gold veins of California and silver veins of Nevada, which the lawmakers had had chiefly in view; and the provisions of the law were applied with difficulty to the great ore bodies in the "blanket-lodes," "chambers," and "mineral-bearing zones" of Utah, Colorado, and Arizona. Vast sums were squandered in litigation before even the meaning of the terms in the statute defining the extralateral right could be fixed by the U. S. Supreme Court.

Meanwhile, the owners of large mining properties have learned to protect themselves by executing mutual quit-claim deeds or side-line agreements with neighbors, or by purchasing outright such adjoining territory as threatens future conflict of title. In fine, the volume and cost of mining litigation has been greatly reduced, though the expense and difficulty of perfecting title by patent is still too great, and the nature of such title too indefinite. This improvement in the situation, being largely due to the practical abolition of the extralateral right by agreements between neighbors, is an argument rather for the repeal than for the continuance of that feature of the land laws.

Indeed, all the changes in the situation above enumerated seem to me to call for such a repeal, even at this late day. But there is a new factor which may greatly hinder that simple and obvious reform. I refer to the movement for an entirely different treatment of what are called national resources. It seems likely that any attempt to amend the law of the apex will be seized as an occasion for proposing to abolish altogether the system under which, for half a century, the public mineral as well as agricultural lands have been sold to citizens. Present Taft, it is true, in a public address advocating the operation of coal mines and water powers under Federal leases, disclaimed the intention of altering in this respect the laws concerning other mining titles, which he said were working well enough already! But President Taft's limited outlook and moderate suggestions will not satisfy the partisans of the new "nationalism." In my recent paper, cited above, I have discussed this question, and must reserve further statements concerning it, including replies to criticisms of that paper, for another place. I mention it here simply to express my apprehension that the movement for a practicable reform may fail again, as it has failed at

least twice already, through the attempt to accomplish too much. The proposal to change many provisions of the present law (to say nothing of a total change of its purpose—namely, that of transferring the public lands to citizens, and the subsequent control of them to the Territories or States in which they are situated) will have, in my judgment, as it has had already, this result: that the opponents of any one of the proposed changes will unite to oppose them all, and the friends of any one such proposed change will be divided as to some of the others, so that it will prove impossible to make a clear and simple issue, upon which the needed majority could unite. This constitutes an important factor in the consideration of the subject assigned to me by the Chairman of the Institute Committee on Mining Law, at whose request I have written this paper.

VANCOUVER ISLAND LABOR TROUBLES

Victoria, B. C., Feb. 17.—Yesterday was the field day in the Legislative Assembly of the industrial struggle on Vancouver Island.

It was not the first occasion on which the unsettled labor conditions in the coal mining districts have formed the topic of discussion in the Legislature, but the labor difficulties in that section have never before occupied the attention of the Members throughout an entire session.

The Premier, who spoke for more than an hour and a half, devoted a considerable part of his speech to showing that the real cause of the industrial disturbances was not the report of the Gas Committee, as has been alleged by the opponents of the Government, but a determination of the United Mine Workers of America to control the labor situation in the coal mining districts of the Island. The Premier was careful to point out that he had no quarrel with any labor organization, but he taunted the Member for Newcastle and his followers for refusing to come out manfully with the statement as to the real cause of the disturbance, preferring to draw a herring across the trail in the shape of alleged shortcomings of the Government.

The Premier, in resuming the debate upon Mr. Place's resolution of no confidence, regretted the fact that it had been impossible for him to speak immediately after the mover of the resolution, because, he thought, his remarks might then have carried an even greater significance. He was grateful, however, for the opportunity presented to express himself on the subject and made the position of the Government well known throughout the country.

Attitude Towards Labor.

Dealing with the attitude that the Government took in regard to labor, the Premier said he would make the general statement that towards labor in British Columbia the Government had always been fair, and proposed to continue in that attitude. He said that he knew and expected that the Government would be asked from time to time to advance certain legislative measures in regard to labor, and the Government proposed without hesitation to act upon any legitimate suggestions which might be offered. The Government was not a labor Government, but there would never be any disposition on its part to do other than act in a fair-minded manner to all classes of the community.

"The Government wants this to be a workingman's country. We claim it to be a land of opportunity. There is no section of the world to which the worker can come that offers him greater prospects than does the Province of British Columbia. But we are sensible of the fact that when we invite the worker to come here, we must, in the same breath, invite capital to come also. There would be absolutely no point in inviting the workingman to come to this country if we did not at the same time invite the interests of capital; and, successful as we have been in bringing large numbers of workmen to this country, we have not been less successful in bringing capital as well."

The Premier challenged the Members of the Opposition on their inconsistency, and pointed out that it was difficult for him to understand how they could be sincere and logical to their own attitude regarding the welfare of the workingman when they declined absolutely to consider for a single instant the interests of capital, upon which to a very considerable extent the development and prosperity of the country was dependant. They were so wrapped up in the rights of the workmen that they were not in a position to consider in a fair-minded manner the other interests of the country. In fact, he had never heard from the lips of either the Member for Newcastle or Nanaimo a single sentence that could be construed as conceding to capital the slightest consideration whatever.

Nothing in Charges.

"Now, sir, we come to the subject of the resolution, which asks that the confidence of the Government should be forfeited because of the strike at Cumberland. Who is there in British Columbia who proposes to follow the honorable Member for Nanaimo in his charges against the Government who will not conclude with me that there is no man in the Province who knows better than he does that there is little or nothing in them, either against the Department of Mines or myself as Prime Minister. The whole case of my honorable friend is destroyed at once by references to his very strong remarks favoring the recognition of the United Mine Workers of America, assuming control of the mine workers on Vancouver Island, because the organization had so much strength and power behind it. Of course his reason for the strike as given to the House was because the Department of Mines would not investigate a certain charge of discrimination which was submitted some months ago by members of certain organizations.

"The honorable Member for Nanaimo proceeded to argue that the workers on Vancouver Island would be foolish indeed if they attempted to set up a local organization in place of the all-powerful United Mine Workers. We know perfectly well that this is the bottom of the trouble, but it so happens that those who were in charge of the progaganda on the Island right from the start, felt that perhaps they might get a better footing if they could throw the blame on some individuals. and preferably on the Government. They have worked up their case studiously, and it is one which, unless investigated, would appeal to many, but, upon being carefully looked into, one can quickly absolve the Government from any blame in the matter, and as quickly place it where it rightfully belongs, and expose to the country and Canada as a whole that they themselves are responsible for the situation that exists to-day."

"Seeking a Dictatorship."

Proceeding to discuss the relation of the United Mine Workers to the strike situation, the Premier pointed out that the organization had taken the stand it had because it was felt to be a strong one, well knowing that to come out definitely and acknowledge its true attitude, which amounted to that of a dictatorship, would be rather an extreme step to take all at once. For his part, he said,

he had no word of criticism to offer the United Mine Workers of America. It had a perfect right to find a place for itself in this Province under the law, and he did not desire to give utterance to any sentiment that might be interpreted as being antagonistic to the organization.

"The Government is not opposed to international unions. On the contrary, I have tried to make it clear in the House and on the hustings that this Government has no desire to interfere in the relations between employer and employe; that these are matters that may be admitted by the parties directly concerned, and that, the moment any administration attempts paternal interference or control, the time has arrived when Governments and Legislatures are brought face to face with most complex and difficult problems."

Statements of Mr. Farringdon.

Reverting to the strike situation, the Premier reiterated his statement that the whole difficulty had arisen because it was proposed that the United Mine Workers should be in control of the vicious person I am. Yet they must be followed up by quoting extracts from a statement made by Mr. Farringdon, one of the principal officials of the United Mine Workers' organization. He showed from the statements of Mr. Farringdon that it was the object of the organization to obtain control of the coal mines on Vancouver Island, because, when that was accomplished, the organization would be in a position of entire control in the coalfields of the Pacific Coast.

"It appears that the coal mines of the Coast are for the most part in the hands of the United Mine Workers of America, but that at tidewater in British Columbia are the valuable mines of Vancouver Island, and, in order to have complete control of the labor situation as it affects the coalfields of the Pacific Coast, it is proposed that this union shall take possession of Vancouver Island. There is no law in the country against this course of action, but it must be remembered that there is a proper form in which the task should be approached."

Covering Up Motives.

He pointed out that there was no reason for the union organization to cover up their motives in this matter by endeavoring to shift the blame of something for which they were entirely responsible upon the Government. He could not understand why they should be ashamed of what they were doing and endeavor to bring it off in the dark, as Mr. Farringdon had done. There was no reason, he said, why the country should not have been told plainly and honestly that it was their intention to secure control of the miners on Vancouver Island and in that way the control of the coalfields generally.

The Lemieux Act.

Referring to the declaration made by the miners' representatives to the effect that they had gone on a holiday because they did not wish to go on strike as they were afraid of the operations of the Lemieux Act, the Premier said that he took the trouble to point out this act to them, but they would have nothing to do with it.

Calling Out the Militia.

"With regard to the calling out of the militia," proceeded the Premier, "it matters not whether the scene be the coal mining district, the metalliferous districts, or anywhere else, when, on certain reputable authority, it is alleged that disturbing conditions obtain, there is no other course for the Government to pursue than the one followed in this case, regardless of whether it means the life or death of the Government. And so it was in this case. I care not what the composition of the Government may be, Liberal, Socialist or Conservative, when the time comes in this country that the Government flinches from its duty in an emergency of this sort, then the day has come when responsible Government is at an end, and when the liberty of the subjects will have perished."

United Mine Workers' Organization.

The Premier concluded with a final reference to the United Mine Workers' Organization.

"They have the right under the law to conduct their campaign in their own way and also have the right, so far as they may be able to exercise it, to control the mines on Vancouver Island, but let it be remembered that in the exercise of a privilege of this kind they have no right to go beyond the law any more than anyone else, and although it may appear obnoxious and restrictive and unfair, they must never claim, under our constitution as we are taught to know and believe in it, that they have a bit more license than any of their fellows. There are constitutional means of settling all those questions, and let us abide by these if we propose to be at all worthy of the land in which we live.—The Daily Colonist.

BUTTE MINERS AND THE AMERICAN INSTITUTE OF MINING ENGINEERS

Patrick Corrigan
Benny Tibby
Consulting Miners.

Butte, Mont.
Feb. 14 1914
St. Valentine's Day.

Misther Rand;

Pres'dent American Institoot of Miners,
Rock-sharps, Metal-melters and Assayers;

Sorr;

The mimbers of this firm were glad to mate you and the other D'rectors of yer Institoot lasht sommer and we arre shure that we kin do yure Institoot a heap o' good. The gra'at throuble wid the Institoot this very minute is the ondoo infloonce of the High-brow Iliment. Ye hev got too mooch of these coll-idge perfissors, who aint no good aboot a moine and who do be allers making throuble. We know that ye, yersilf, come into offis afther the Institoot had had a bad dose of wan o' thim, and wot has set it on its two feet, solid-like is the fact that ye are a practical man. We know that ye are an old railroader, accoostomed to shtand off the Car-wheel Turners Union and the loikes o' thim ;and that ye've managed moines and know how to handle the lab'r'ing man. The Institoot has had wanderful succiss undher yure manidgment, but ye ought to allers beware o' thim high-brow fellers.

The grea'at future hope o' the Institoot lies in the fact that y' are to be succeeded by me old frind Ben Thayer, one of the foinest practical miners in Ameriky and an old Butte man himself. Shure I moind the time that Ben coom out to Butte, wid his collidge diplomy of Civil Ingineer, and how he felt he had to be civil to ivribody down in the ould Anniecondy shaft, where he got his first job with me and Ben Tibby. Shure he'd say "Beg yure pardon will ye give me the wrinch," and "Excoose me ye' ve got me shtriking hammer."

But we had to take all that nonsense out of him and bimeby he larned to talk like anny Paddy in the shaft. Oho! he was a lad of foine feller was Ben, and we're all proud of him here in Butte. He'll keep yoors Institoot booming along joost loike the Anniecondy moine. But wot I meant to imphisize was ye have got to knock the collidge bizness out o' these fellers before they're much good, and it's the Anniecondy shaft that giv' ye yure next Pres'dent and doant ye go to thinking anything diff-rent. I've seen a lot o' these collidge fellers in my toime. Some o' thim makes good miners and some o' thim don't, but goes to raisin' apples down in Wash'ton State. The boys that takes to minin' do be sometimes gitting quite a big wad. Sometoimes these fellers with the wads goes back to see their old perfissors and ye ought to hear thim tell aboot it when they come to Butte. "Shure," says wan, "there's Perfissor Flunkem," he says, "he busted me all to shplinters in Mining 206," he says, "or maybe Jollidge 77,55 he says, "or Ingeering 57A," he says, "but whin he see me coming the old humbug says, says he, thinkin' maybe he'd git a new lab'tery out o' me, 'Hellao Jack Hammond, me brave bye," says he, "we want ye for a perfissor," says he, or "Oho! if it aint me old shtudent Par-rk Channing," says he, or "By gracious, "it's me old Boy Chister, so 'tis," or perhaps, "well, Hennen, ye look a bit stouther and older in the face than the slim lad o' '75," says he; but all this blarney dont work or bomboozle the bhoys a bit, it dont. I foind all this out by talking wid thim, and it all goes to show ye've got to look out for these high-brow fellers in the Institoot.

Ye've been rather running thim too hard in the Committees, Misther Rand, but I'll coom round to yure Committee prisintly, so I will. I hev got a bigger thing than that on me moind now, so I hev.

Ye do be making a bad mistake in gineral policy, the way things do be going in this country, and it's going to get yure Institoot in the same throuble as is plaguing the New Haven Railroad; the Shteal Trust; the Rockyfeller crowd; the United Segarr crowd and all the rest. Ye see with thim Machinery chaps, and thim Illictrical fellers, ye've been gitting up a Thrust in Ingineering Sassieties and have put all yure m'terial prop'ty in the hands of a holdin' comp'ny called the United Ingineering Sassiety. The whole bizness involves the stifling of competition, interlocking d'rectorates, monop'ly, and all thim turrible things. As shure as ye're born, ye will have the Attorney Ginral of the United States on yure neck before ye know it. I doant know how yure going to divide up the big building among the Founder Sassieties and the Affiliated Sassieties; or how yure going to stand off the sleepless officers of the guv'ment; but my advice is to get yure new Prisident to appoint a Committee with Jahn D. Ryan, another Butte boy, as Chairman, and have him keep ye out of throuble, same's he has the Amalgamated.

Yure Institoot is now nearly out o' debt, thanks to me old friend James Douglas, for whom f'r a toime I pounded shteel in the old Copper Quane moine prop'ty. Shure the Copper Quane moine has been a fine thing for the Institoot, but ye might as well make other plans for the future. Ye cant expect to high-grade in the Douglas shtope much if anny more. I observe that the Kaiser Wilhelm is now said to be the richest man in Germany, and I think ye might make him Honor'ry Lootenant Gin'ral or Hon'ry Grand Field Marshall of the Institoot, wid a big sword, and maybe he'd do something handsome fur ye.

I note that undher yure manidgment the policy of Committees has been diviliped widout end. That's another Butte idee in spechulization. Ye got it the lasht toime ye was out here from Hennessy's big Department Stoore, right down undher the Annycondy offises. Hennessy has a pins and needles department or committee, wid a speshul floor-walker or chairman; a pants and overalls department wid its own floor-walker; a pick and shovel committe wid its chairman who is a spshulist in iron and steel; and so on, and so on. Hennessy adds wan new department or Committee a week, same's you do; and he's growing like hell punkin vines, running all over ivry where, same's you be.

But I'll tell ye this. Hennessy dont be putting no collidge perfissors in the floor walkers jobs. Bet yer life he doant. Now take fer instance yure Committee on Mining Jolligy. Who'd ever want to moine Jolligy. Jeeoligy means rocks and no miner mines rocks if he can help it. He mines ore. But if ye must have this Committee it's a dam good wan f'r the collidge perfissors. Round 'em all up and put 'em on it. I hear ye tried to git one of them who hadn't been a collidge perfisser very long f'or the floor-walker of this committee but he wouldn't stay on the job. Gee! if he'd been a collidge perfisser ten years ye couldn't a pried him off with a crow-bar.

And then, there's the "I run and Shteal" Committee; ye've got another wan o' thim high-brows there. I doant know what it'll be coming to. Afther a good practical man like yersilf, and afther the great, practical jurnalist of the Institoot set it a-going, it's too bad to lave the paapers on good, furniss cinder and pig iron behind, and discoos the "A3 diagram o' carbon" which doant say nothing about iron or shteel eether. Now take the Peetroleum and Gas Department, undher the greates Floor-walker of thim all, me ould frind Cap'n Tony Lucas. Look what he do be doin'. So much Gas it do take three full days of the annual meeting to blow it off, and all the other Departments c'n go to hell some other building to meet in.

And now I must say a worrd fer yure Secret'ry, the reformed high-brow. Ye caught him young enough to make quite a man of him yet, and I do be hearing the bhoys say he's the rale stuff.

I enclose me bill, and I head off me pardner, Ben Tibby from ventilating yure Institoot anny more. Annyhow I've had me chanct to pay me respicks to yer ould high-brows and I'd raher do the job f'r nuthin' than not hev the chanct.

Respectfully,
PATRICK CORRIGAN,
Consulting Miner.

CANADIAN NORTHERN RAILWAY MOUNT ROYAL TUNNEL.

In our last issue we published an account of the driving of the Mount Royal tunnel. This account was written originally for the Sullivan Machinery Co. by Mr. D. J. O'Rourke. Naturally, under the circumstances, attention was directed especially to the results obtained by Sullivan machines.

It should not be inferred, however, that these were the only machines used on the work.

In addition to the Sullivan machines, over 30 Hardy Simplex hammer drills were used in the tunnel. A considerable proportion of the drilling was done with these machines, especially in the trimming work.

CHECKING THE FLOW OF WATER INTO SHAFTS BY THE USE OF CEMENT GROUT*

By Francis Donaldson.

The direct injection of cement grout into water-bearing fissures as a means of checking or stopping the flow of water into shafts and tunnels has been experimented with for a decade or longer and seems to have been first attempted in Europe. The earliest application of which the writer has found a record was at a shaft sunk by the Mining Society of Lens; this is described by C. Dinoire in the Transactions of the Institution of Mining Engineers.

It is only lately, however, that the process has been entirely successful. This success has been accomplished on the Catskill Aqueduct, now under construction by the city of New York. This aqueduct includes a number of deep pressure tunnels, reached by shafts for both waterway and construction purposes. In portions of these shafts and tunnels considerable underground water was met. The contract for the first of these deep pressure tunnels was let to the T. A. Gillespie Co.; this section is known as the Rondout Siphon. It leads under the Rondout valley at a depth of from 400 to 800 ft. and is about 5 miles long. The engineers expected that considerable water would be encountered, but fortunately this was not the case, except at one shaft, known as No. 4, which penetrated the rock at a junction between limestone and conglomerate. Water-bearing fissures were encountered almost immediately. At a depth of about 200 ft. a flow of 1,500 gal. per minute was struck. The shaft then contained as many pumps as could be used, and it seemed impossible to sink it further. After vain efforts had been made to proceed, John P. Hogan, a division engineer of the Board of Water Supply, suggested that cementation of the fissures be tried. The process was attempted for the first time in this country. Since the shaft was partly full of water it was necessary to drill grout holes with a diamond drill. Platforms were placed on the timbers at the water level, the diamond drill was installed, and six 90 ft. holes were drilled in the bottom of the shaft. Several carloads of cement were pumped through these holes into the fissures, the drill casings being used for grout pipes. This largely cut off the flow of water from the bottom and sinking could then proceed. After that, water-bearing seams were grouted as soon as encountered, and the contractor was able to finish the shafts and tunnel within the contract time. Shaft No. 4 was a rectangular, timbered construction shaft with no concrete lining; consequently it was impossible to cut off any of the water coming in from above the point where grouting was first attempted. On this account large volumes of water had to be pumped until the tunnel was finally sealed.

At the next wet shaft the writer had to do with, advantage was taken of the experience gained at shaft No. 4. At this second shaft, No. 4 of the New York City Siphon, good progress was made until a depth of about 100 ft. was reached. The first hole drilled in the bottom below this depth struck a stream of water; the flow amounted to about 150 gal. per minute. This was plugged. It was found that each of the 12 holes in the sump cut encountered the same stream of water.

As soon as each hole cut the water-bearing seam it was plugged with a tapered wooden plug. After all the holes in the sump had been drilled and plugged in this way, the grout connections were made one at a time, so as to restrict the flow of water into the shaft. Each connection was made with a piece of 2 or 2.5 in. iron pipe about 3 ft. long, threaded at one end and given a long taper at the other. The tapered portion was made rough on the outside by nicking it with a chisel. A heavy iron stopcock was screwed to the pipe, the tapered end wrapped in several thicknesses of burlap, the wooden plug removed from the drill hole and the tapered pipe driven in, the stopcock being left open. This was the most exciting and the wettest part of the job. After the pipe had been driven in hard the stopcock was closed.

In this case connections were placed in all the wet holes before grouting. The grouting machine or tank used on the aqueduct was the Caniff machine, in which the grout is mixed by air. It is built like an air lock with a door on the top, through which cement, sand and water are introduced, and has a 2 in. discharge opening in the bottom and air connections top and bottom. The discharge opening is connected to the grout hole by a heavy rubber hose. Another 2 in. stopcock is placed at the outlet of the tank and a 2 by 1 in. tee is placed between the hose and the cock attached to the pipe in the drill hole. Into the side opening of this tee a 1 in. stopcock is screwed.

The machine is installed at the bottom of the shaft, and is connected to one of the holes and also to the high-pressure air supply. The 2 in. stopcock on the machine is closed and the other is opened. The door in the top is opened, a sack of cement, three or four buckets of water, and (if the cavity to be filled is large) a sack of fine sand are poured in, the air connection at the bottom is opened and the air allowed to bubble through and mix the grout. Then very quickly the door is closed, the lower air connection is closed, and the discharge connection and the upper air connection are opened, and the air enters and drives the grout into the cavity. A man stationed at the 1 in. stopcock keeps opening it a crack; when air shows instead of grout he closes the 2-in. stopcock and the machine is recharged. If the cavity is open the charge is pushed in in 3 or 4 sec. By working continuously more than 1,000 batches can be placed in 24 hours.

The grouting of the fissure was successful and sinking was resumed. About 50 ft. further down another water-bearing fissure was drilled into, and this, instead of being open, was filled with sand formed by the crushing of metamorphic gneiss due to folding; this sand was carried up out of the drilled holes in large quantities by the water. Grout will not permeate sand and it was necessary to continue drilling holes and pumping in grout, increasing the pressure at the end from 100 to 400 and 500 lb. to the square in. The sand was tamped so full of cement that when cut through it was compacted like sandstone and contained balls of grout from the size of a fist to as large as a man's head.

The most difficult grouting on the aqueduct was done on the Hudson Siphon, which is a deep siphon tunnel under the Hudson river at a depth of 1,100 ft. below tidewater. The shafts were sunk by the city forces,

*A Paper Read at New York Meeting A.I.M.E., February, 1914.

after which the contract for the driving and lining of the tunnel and lining the shafts was let. About 150 ft. from the foot of the east shaft the heading cut a water-bearing fissure which flowed about 300 gal. per minute. The full flow did not develop until the cut was blasted. The problem then was to grout this flow against a hydrostatic pressure of 500 lb. per square in., with no solid rock to which to make grout pipe connections. This problem was finally solved by the construction of a concrete bulkhead 8 ft. thick across the full section of the head. The concrete was mixed in proportions of 1:2:4 and was heavily reinforced with rails set into holes drilled laterally into the sides, roof and floor of the tunnel. Grout pipes leading into the fissure were set through the bulkhead. After the concrete had set for a week, grout was forced into the fissure, first by the pneumatic process with a high-pressure air compressor and finally by means of a high pressure plunger pump which forced water instead of air into the grout tank. Pressures were reached in this way up to 1,000 lb. per square in.

In driving or sinking through rock containing a large number of seams carrying small quantities of water, it is not practicable to stop and grout each seam as described above. In this case it is advisable to increase the section of tunnel or shaft sufficiently to allow for a heavy concrete lining. Drains should be provided opposite all of the water-bearing fissures to carry off the water while the lining is being placed. After the concrete has secured sufficient strength, the drains may be grouted. By a combination of these two methods it should be possible to penetrate any firm rock, no matter how much water it contains.

BRITISH COLUMBIA COAL COMMISSIONERS' REPORT

Last year Mr. W. E. Burns, of the City of Vancouver, was appointed by the Government of British Columbia to make enquiries into various matters connected with the cost of coal to consumers and to obtain all available information relative to this question. His report was recently delivered to the Government. The Daily Province, of Vancouver, on January 27 published the following review of the report:

Bulk delivery of coal instead of delivery in sacks as at present, reduction on freight rates from the interior of British Columbia, establishment of sizes and quality of the various classes and grades, supervision of such classes and grades, and supervision or inspection of mine weighing and weights are recommended by Coal Commissioner W. E. Burns, of Vancouver, in his report which is now in the hands of the Provincial Government authorities. Commissioner Burns forwarded his report to Victoria last week, and it has been before the Provincial Executive for consideration.

It was stated that there is little likelihood of legislation being framed during the present session upon the recommendations of the report, as it is the desire of the authorities to give the various interested parties ample time for looking over the findings of the commissioner, and presenting suggestions. It is believed, however, that something in the way of legislation along this line will be brought down next year.

Mr. Burns' recommendations follow: The establishment of the sizes and quality of the various classes and grades of coal known to commerce as applicable to all of the different coal fields of the Province.

The establishment of a method of supervision or inspection, Government or otherwise, of classes and grades of coal sold and dealt in with accompanying incidents of enforcement. This object might be accomplished by the natural working out of the opposing interests of buyers and sellers in the trade if sizes and quality were standardized.

The establishment of a method of supervision or inspection, Government or otherwise, of mine weighing and weights.

Consideration of the advisability of adjusting conditions in the industry at present upon the long-ton basis to the short-ton basis.

The establishment of bulk deliveries to the customer in the larger places at least, either by means of legislation or by arrangement with the civic authorities with accompanying inspection and regulation of weighing methods. In connection with this steps should be taken to ensure that reduction in prices to the consumer which the elimination of costs established would warrant.

Consideration of the advisability of steps being taken to afford if possible a sufficient reduction in rates on coal from the interior to the coast to enable the interior mines to compete in the coast trade.

Mr. Burns, during his investigations, which were commenced at least a year ago, was required to take up a large number of phases of the coal-price situation. Among other things, he enquired into the cost of production, cost of transportation, cost to dealers within and outside of the Province, cost to consumers within and outside of the Province, profits made by mine-owners, profits of dealers, alleged shortage of coal and reasons for such shortage within the past five years and whether such shortage was occasioned by the shipment outside of the Province or coal mined here.

A portion of the report covers an account of the sessions held during the investigation and the obtaining from the operators of accountancy statements. In this connection the commissioner states that operator and dealer without exception met him with an attitude of complete and unreserved disclosure of their business details and methods. In addition to examining consumers, dealers and operators, the commissioner went through various mines in the Provinces and also visited the yards and plants of city dealers.

Summarized, the principal complaints made to him by consumers were: High prices, inferior quality, shortage in weight and shortage of supply.

Dealing with the methods employed by operators and dealers in handling coal the commissioner explains that as the coal of the Province is of a soft and friable nature the operator has had to look to the large or lump coal for his profit, and the dealer in turn has had to look forward to and absorb a loss on the smaller coal and on the slack created in transit of the lump coal.

A lengthy account is given of the mining of coal and also of the way in which the dealers handle it, which is followed by a discussion of production costs. The commissioner gives the following figures as the average cost per long ton of the mines upon a permanently producing basis in the Province: 1908, $2.71 to $3.19; 1909, $2.68 to $3.21; 1910, $2.56 to $3.34; 1911, $2.78 to $3.36; 1912, $2.44 to $3.46. These figures would appear to show that the cost of production at the mines has not changed materially, although the maximum cost has steadily risen. Important features of the mining production costs, he points out, are: The fact that a comparatively large amount of rock paid for right through the mining costs without return, the fact that the percentage of the total production of screenings made at the tipple ranges from 30 to 50 per cent., and the varying prices of both contract and company labor.

A full table of water rates to the chief cities along the coast is given. The figures show that from Ladysmith and Union Bay the rate to Vancouver is 50 cents, including insurance; 45 cents from Boat Harbor with insurance additional; 50 cents from Nanaimo, including insurance; 60 cents from Seattle and 70 cents from Tacoma. There is an additional charge of five cents per ton for False Creek dealers for transferring in from English Bay. The rail rate to Vancouver from Merritt is $1.80, with $3.50 from Princeton, Crowsnest and Bankhead.

It is noted that most of the larger dealers do a wholesale coal agency business, receiving from the mines a commission on direct sales of scowload or carload of from 3½ to 5 per cent. Since 1907 the selling prices of the Vancouver Island mines have remained about the same, the coal being sold there by the long ton, and from the interior mines by the short ton. With the exception of the Vancouver-Nanaimo Coal Mining Co., which sells lump coal at $4.75, the prevailing price is $4.50. These prices are at the mines. The Nicola Valley Coal & Coke Co. sells at $4.50 to $5 at the mine for lump coal; the Princeton Coal & Land Co., at $3.50; The Inland Coal & Coke Co. at $4; Crownsnest Pass Coal Co., $3.25, all these prices being for screened lump coal. Prices at American mines sending coal into British Columbia are also given in detail.

That there is no unreasonable profit in any branch of the industry is one of the conclusions arrived at by Commissioner Burns. He states that dividends have only been paid by three of the operating companies up to the end of 1912, and these dividends have in no case averaged over 10 per cent. covering the period of operation.

Storage of Coal.

In connection with the question of shortage he points out that the absence of storage methods on the part of dealers is due to the extra handling required, the outlay of money, danger of fire and deterioration in the coal. The stock on hand, he says, has hardly ever been as large as would equal an average month's business in a colder period of the year. The mines do little storing and the dealers only attempt it to some extent in the summer. The commissioner himself does not think that the establishment of any greater storage facilities by the dealers could be required. For householders, he suggests that two bins for a ton each, be provided, and both filled to start the winter, an order for an additional ton being placed as soon as one is empty. He points out that it might be a good move on the part of dealers to offer a discount for coal sold during the summer months in order to induce consumers to lay up a winter supply early.

Speaking of the outside supply provided by mines, he states that evidence produced before him shows that the Vancouver Island mines have cut off their outside markets when the local markets demanded their full capacities. Coal shortages have in the past arisen out of abnormal conditions, he thinks, and little danger would occur if dealers spread their sales more uniformly throughout the year and the operators preserved a policy of serving local demands first.

The 50 cents extra charged by the Vancouver-Nanaimo Coal Mining Co. for its coal, it is explained, arises out of the fact that this concern signed up with the United Mine workers during the recent strike at an increased scale of wages, and therefore provided with its agents for an increased price of coal until the other mines were operating to their full capacity.

PORCUPINE CROWN.

(Financial Times, Montreal.)

The main vein of the Porcupine Crown has been cut by a crosscut on the 500 ft. level, where the vein was about 5 ft. in width and of high grade ore. It will be remembered, by those who follow Porcupine Crown developments, that the winze which was sunk on the vein below the 400 ft. level was in good ore until a point 70 ft. below the 400 ft. level was reached, at this point the vein was over 5 ft. in width and assayed $70 per ton; the vein then dipped out of the winze. The crosscut which was run at a point further to the south cut the vein at the point anticipated, and showed up equally good ore.

Developments on the vein at depth seem to show that the ore shoot is, at the lower levels, further to the south than is the case on the upper ones.

Recent developments have been very satisfactory from other points than developments on the main vein now being worked. The extensive campaign of diamond drilling has been of great importance and most successful.

A development of importance is the cutting of what appears to be an entirely new ore body, some 200 ft. to the east of the main vein. The vein, judging from its position where cut is almost directly under a vein which was found in the trenching first done on the property, and which carried values.

It may, however, be an entirely new vein on account of uncertainty in surveying drill holes. The extension of the main vein to the south, as found by diamond drilling, should be cut in about a month by the cross-cut now being run on the 200 ft. level. At the new shaft (No. 5), which is being sunk towards the southern boundary of the property, crosscutting was discontinued at the 160 ft. level, and a new crosscut was recently started to develop ground at depth which diamond drilling showed a vein carrying high gold values. This is apparently a further extension of the main vein to the south. The diamond drilling operations also cut the main vein at a vertical depth of 600 and 700 ft, from both of which points cores carrying free gold were obtained.

The next few months should witness some very important developments at depth, which will connect up the various present workings and show the true length of the ore shoot on the main vein, and also cut either veins which recent developments have shown to exist at depth, as well as on the surface. The important feature of recent work is the fact that on every adjacent property diamond drilling has been a sure indication of the presence of ore bodies, and subsequent work in the ordinary course of mine development has only gone to prove the importance of diamond drilling in prospecting for ore bodies.

PORCUPINE THREE NATIONS.

The annual meeting of the Porcupine Three Nations was held last week at the office of Day, Ferguson and O'Sullivan, Toronto. The principal business was the confirmation of an agreement for the transfer of the company's mines to a new company, to be called the "Porcupine Three Nations Consolidated," which is controlled by Treffle Bastion, J. T. R. Laurendeau, and J. W. Blanchette, of Montreal, who have agreed to erect a stamp mill and cyaniding plant, and a power plant, and to actively carry on the mining development. The Three Nations property is in Whitney Township.

GOWGANDA SILVER DEPOSITS**

By W. H. Collins.

Since 1903 silver-cobalt ore has been found locally across the whole width of Nipissing district—72 miles—and for an almost equally great distance north and south. The whole included area is not less than 1,600 square miles. About 650 square miles of this lies within the limits of the accompanying map, chiefly in its southeastern half. The known productive part of this 650 square miles is practically confined to the diabase formation. As the diabase is not uniformly mineralized, it is possible to further limit attention to a number of localities that include most of the known deposits and in which mining camps have been established. James township and portions of Willet, Mickle, Farr, Smyth, and other townships to the east may be called, collectively, Elk Lake district, as the village of Elk Lake forms their business centre. Gowganda village is in like relation to operations in Milner and Nicol. While these two townships include a large majority of the working properties in Gowganda district, others are scattered through Leith, Charters, Lawson, Haultain, Van Hise, and even as far as Morel. A small and isolated silver-bearing area in Leonard township is commonly designated Shiningtree district owing to its proximity to Shiningtree lake. The properties in Speight and Van Nostrand townships, just east and southeast of Banks, lie along the eastern side of Maple mountain, and are known consequently as Maple Mountain district.

In all four districts mineralization rarely extends beyond the diabase formation. The principal vein on the Blackburn or Millerett property at Miller lake lies in conglomerate not far from diabase, and one on the North American claims at Silver lake traverses both diabase and an overlying quartzite, but these are the only important ones known to occur in the Huronian. At Cobalt, on the contrary, most of the ores have been found in Huronian rocks. The significance of this difference is not yet known. Diabase and Huronian are of similar character in both districts, and the Huronian has been little folded in either. But while the diabase throughout Gowganda district bears to the older rocks the relations of tabular sills not often exceeding 500 feet in thickness, recent underground developments at Cobalt are leading to the opinion that the diabase is more irregular in form and may extend to very considerable depths.*

Few of the mine workings are over 150 feet deep, so comparatively little is known about the vertical extent of mineralization. Some inferences may be drawn, however, from the general restriction of veins to diabase masses. Apparently veins do not extend far above or below the diabase sills, and the thickness of the latter determines the depth to which they may go. For the same reasons veins are not likely to extend far below the base of the Cobalt series, since diabase sills are not known within either Keewatin or Laurentian, though they commonly rest upon these formations. However, the sills cannot be considered as uniformly thick, especially where they lie upon the unequal surface of the crystalline basement, nor can the possibility of local divergences from the general sill form be entirely excluded.

General Character of the Deposits.—The ores occur in distinct veins of small size. Very large ones are 18 inches or 2 feet wide and the majority are from half an inch to one foot. As a rule they occupy well defined vertical fissures in the diabase or Huronian, extending in nearly straight lines along the surface. Devious, forking veins were seen only on the York property near Silver lake, where they appear to have been influenced by a columnar jointing in the diabase. A large number near Gowganda extend nearly east-west, and others nearly north-south, but for the entire district the strike shows little distinctive regularity. Locally, however, the veins have a conspicuously parallel arrangement. On the Mann property (H.R. 252), west of Gowganda lake, for example, there are four veins only a few yards apart, all of which strike N. 15° E. Seven parallel north-south veins occur within a total width of 300 feet from east to west on the Neeland claim (H.S. 448) in Shiningtree district. In most cases the veins have not been traced for more than 400 feet, owing to their disappearance, junction with other veins, or to the work of stripping becoming too difficult. Occasionally they are longer; a 20 inch vein in the diabase between the two arms of Gowganda lake is traceable for 1,500 feet, crossing one mining claim.

Being largely calcite-filled, the veins erode more rapidly than the country rock and are represented at the surface by crevices, either empty or filled with soil. In some cases they are concealed by a firm but thin cap, formed by recementation of the weathering products. This is frequently mistaken for diabase by prospectors, and has led to the belief that veins may be "capped" by diabase. The inconspicuous surface expression is further increased by the moss and forest growth which cover much of the area. But on cliff faces and other exposed rock surfaces, a useful exploratory criterion is afforded by cobalt bloom, a weathering product of smaltite, which produces a characteristic pink or carmine red stain.

Veins and wall-rock are separated in clear-cut manner. The latter has been affected to some extent by vein solutions for a distance of about a foot, and contains some silver and smaltite, chiefly as minute crevice fillings. A considerable part of the low grade ore is obtained from this impregnated wall-rock. Within the veins gangue and ore minerals vary greatly in relative amounts; in many cases the latter are represented only by scattered grains of chalcopyrite. Even in rich veins the ores are not as a rule uniformly distributed, but have been concentrated in patches a few yards in extent, leaving other parts of the same vein practically barren. Some of the phenomenally rich surface discoveries made at Gowganda in 1908 were of this character. A continuous spine of native silver averaging half an inch in width was exposed for about 20 feet along one vein on the Mann property, and slabs of ore, two of which weighed 240 and 160 pounds, respectively, were taken from near the surface of the Reeve-Dobie claims.

Silver is the important metal. Native silver, smaltite, and niccolite are the principal ore minerals, and calcite the chief gangue mineral, though quartz is also present. The proportions in which both gangue and ore minerals are associated is variable, however, and veins in different parts of the district are so unlike, consequently, that their common origin can be recognized only by their like relations to the diabase. Quartz veins carrying chal-

**Extract from Report on Gowganda Mining Division, Mem. No. 33, Geol. Sur. Canada, 1913

*Canadian Mining Journal, March 15, 1911, page 194.

copyrite are found in the diabase at Duncan lake. One of the veins on H.S. 448, near Shiningtree lake, consists, in its mineralized part, of massive niccolite unaccompanied by either smaltite, gangue, or silver. Those on H.B. 42, Lawson township, on the contrary, consist chiefly of smaltite, with some silver but little or no niccolite. Some of the largest veins near Gowganda are unmineralized and consist entirely of calcite. A small vein of solid chalcopyrite parallels an aplite dike in the diabase at the United States mine, James township.

Ore within a few feet of the surface differs in no respect from that obtained 150 or 200 feet down—the present depth of mining. Alteration is confined to a surface zone, apparently not often exceeding 6 feet in thickness, where calcite has been leached out, and the sulphides and arsenides oxidized. Smaltite changes to a powdery red erythrite or cobalt bloom, and niccolite to the corresponding nickel bloom, or annabergite, of pale green color. Limonite and azurite result from chalcopyrite where that mineral is abundant.

Composition of Veins.—On account of the common preponderance of calcite over quartz in the veins, the presence of the latter is often overlooked. However, it is present in most veins and sometimes becomes the chief gangue. Some of the veins that accompany the Duncan lake diabase sill are composed almost wholly of quartz with central vugs occupied by calcite. Generally, however, calcite is more abundant and quartz inconspicuous or even absent. But while they fluctuate relatively in amount their structural arrangement is constant. Quartz always grows from the walls toward the centre, its individual crystals terminating freely in a usually large median space which is filled with calcite.

Barite veins are much less common than those containing calcite. They occur in company with the latter and bear similar relations to the diabase. They consist of quartz and diabase, and appear to be mineralized chiefly with chalcopyrite. One occurs not far from the shaft of the Calcite Lake Mining Company's mine, on L.O. 357, Lawson township. Others have been found in Shiningtree district and in James township.

The ore minerals form a characteristic group of native metals, sulphides, arsenides, and related compounds of cobalt, nickel, silver, and copper. Native silver is of chief economic importance. It occurs in flakes and a network of veinlets that traverse smaltite, niccolite, and calcite in the veins and, in less profusion, a few inches of the adjacent wall rock. In samples from the White Reserve mine, in Maple Mountain district, it has the appearance of being enclosed by smaltite. Crystal form is known to occur only at the surface of the Mann property (H.R. 252). The first discovery on this claim was a protruding spine of native silver of spongy or arborescent texture, in reality a skeletal arrangement of plates and string of tiny octahedra arranged in three planes intersecting at right angles to each other. The silver met farther down in unweathered portions of the same vein was of the usual irregular form. Small lumps of argentite were found in a small vein of smaltite on one of the Mann group of claims.

Smaltite ($CoAs_2$) and niccolite (NiAs) are the chief arsenides present. Both are massive, and mutually intergrown when found together. At the surface smaltite oxidized to Cobalt bloom ($Co_3As_2O_8+8H_2O$), niccolite to annabergite ($Ni_3As_2O_8+8H_2O$). Imperfect crystals of native bismuth, with striated faces, occur embedded in calcite at the Boyd-Gordon mine, Gowganda, and the Otisse mine, Silver lake; lumps of it were found also on the Lett property at Wapus creek.

Chalcopyrite is more abundant than any of the other minerals, but this fact is obscured by its inferior commercial value. It is particularly common in Elk Lake district, where veins of it are often associated with aplite dikes. The quartz veins in the western part of the district contain this mineral alone and often in considerable masses. It is enclosed by calcite and quartz alike, while the arsenides and native silver appear to associate only with calcite. Disseminated grains of chalcopyrite occur throughout aplite and diabase. Ordinarily it weathers to an earthy brown mass composed largely of limonite, but in veins near Mosher lake azurite crystals have developed from it.

Other minerals occur in unimportant quantities and more or less sporadically. Specularite is common in James and Corkill townships. Pyrite is wide-spread. Magnetite was observed at one point between the northeast and northwest arms of Gowganda lake. In trenching along one vein, a party of prospectors had uncovered a second cross vein filled with a heavy black veinstone, which proved to be calcite filled with microscopic octahedra of magnetite. Galena is found with chalcopyrite in the quartz gangue. Stibnite occurs some miles south of Shiningtree district.

Judging by its constant growth from the walls toward the interior of the vein, quartz was evidently the first formed vein constituent. Chalcopyrite and galena began to deposit at about the same time, as they occur within the quartz. The remainder of the succession has been worked out by Campbell and Knight, from examination of polished ore surfaces. They find that smaltite and niccolite were deposited next and evidently simultaneously, since the two are intergrown. A period of movement succeeded, during which small fractures were formed. Later, calcite and argentite appeared and the fractures became filled with native silver. Bismuth crystallized later than the silver.

Genesis.—The consistent association of the silver-cobalt veins with quartz diabase sills is the most thoroughly demonstrated and significant fact bearing upon their origin. Nowhere in Gowganda district have veins of this type been found in older rocks except in the immediate vicinity of a diabase sill. They are closely restricted to these intrusions and occur in all the large ones that have been described. Though the formations intruded by the different diabase masses are not the same, the veins associated with one sill do not differ notably from those related to another. It is difficult to escape the conclusion that diabase and ore deposits are intimately related. Such a relation was accepted when exploration in Montreal River district commenced, and has proved serviceable in the search for veins.

BEAVER

Cobalt Feb. 25.

The fiscal year of the Beaver ends on Saturday of this week, and when the annual meeting is held at some future date the report will show an increased production. President Frank L. Culver, who is in camp, does not know the exact increase, as the records have not been all checked up, but intimates that a substantial increase will be the result of the year's work.

MICHIGAN COPPER DEPOSITS*

By Reginald E. Hore.

Mode of Occurrence of the Copper.—Practically all the copper mined occurs as the native metal. Arsenides and sulphides are found in some small veins, but the tonnage mined is very small. One lode, the extent of which is not yet known, has copper in the form of oxide, silicate and carbonate minerals.

The native copper occurs chiefly in bedded deposits. It fills cavities and replaces mineral and rock constituents of conglomerates and amygdaloids. By far the richest lode is a conglomerate, but all the others now being worked are amygdaloids. Other types of deposits are fissure veins cutting across the formation, epidotic beds parallel or nearly parallel the formation and disseminated copper in sandstone. Copper has been found in a much altered and fissured mass of felsite.

The bedded deposits are long and continue to great depths. The most important ones are worked for a distance of two to five miles along the strike. Two of the lodes are still being worked at over a mile down on the slope of the beds, and it is probable that others will be worked to a like depth. Most of the lodes average over ten feet in thickness and some over twenty.

Conglomerate Lodes.—In the conglomerate lodes the copper occurs chiefly in the matrix, and has irregular branching forms suggesting that it has filled cavities in the porous rock. In other cases, however, there is copper in forms which show that it has taken the place of other constituents in the rock, and in many cases it has partially replaced large pebbles.

Amygdaloid Lodes.—In the amygdaloid lodes the copper occurs partly, with other minerals, filling the amygdules. Much of it, however, is not in the form of a filling. As a rule the rock carrying high values in copper is to a large extent made up of secondary minerals, and the metal is usually enclosed in masses of these, especially in calcite, epidote, chlorite, prehnite and quartz. The copper, like these and other secondary minerals, is in such cases evidently a replacement deposit.

Fissure Veins.—In fissure veins the native copper occurs in masses, very irregularly distributed. The most usual immediate associates of copper are epidote, prehnite and chlorite. Calcite is abundant in most veins, but calcite veins not showing these silicate minerals seldom show copper. The veins worked were narrow in the traps, but widened out where the fissure crossed more porous strata. Commonly there are numerous masses of country rock enclosed in these veins, all of which cut across the formation and are nearly vertical. A large quantity of metal was taken from such deposits at the Cliff and Central mines years ago, and a very rich vein is now being worked at the Ahmeek mine.

The Chief Producing Lodes.—A large number of lodes are being worked. The most important producing lodes are the Calumet conglomerate and the Kearsarge, Baltic, Pewabic, Osceola and Isle Royale amygdaloids.

The Calumet lode is the cupriferous portion of one of the conglomerate beds in the lower Keweenawan series. This bed continues for a distance of several miles, but the ore bearing portion is confined to that part, about two miles long, which outcrops on the property of the Calumet and Hecla Mining Company, and which at depth crosses into the property of the Tamarack Mining Company. On other properties north and south, development of the conglomerate has not proven profitable. The best ore was in two shoots at Calumet and South Hecla shafts pitching north at about 70°.

The conglomerate rock mined is made up largely of pebbles of felsites and quartz porphyries cemented together with small particles of rock, calcite and native copper. The cementing material contains also, in smaller amounts, other minerals such as iron oxides, quartz, epidote and chlorite. There are a few pebbles of melaphyres, amygdaloids and porphyrites.

The conglomerate is characteristically red, both pebbles and the cement being commonly of that colour. Most of the constituents are of light tones; but a considerable portion is made up of pebbles that are dark reddish brown. Most of the lighter coloured pebbles, light red or flesh colored, are dense felsites and quartz porphyries. The darker coloured ones have usually a finely felsitic ground mass with phenocrysts of brown red feldspar. Other dark brown ones have a very dense ground mass with phenocrysts of quartz. Some are dark coloured felsitic rocks with no phenocrysts. Many of the pebbles show an outer rim of lighter colour than the interior. This results from alteration.

The small rock particles in the matrix are similar in character to the pebbles, but have been more extensively altered. The copper occurs chiefly as part of the cement, filling spaces between sand grains and pebbles, but some has replaced the rock constituents. It is a common occurrence to find large pebbles partially replaced by native copper, and at some rock houses a number of these are picked out every day. While most of the copper is coarse, much is in very minute particles and the ore has to be finely ground to permit of its recovery.

When a large section across the lode is exposed, as in the drifts and stopes, there are usually to be seen rather distinct light and darker colored portions. The copper is chiefly in the light colored portions. The darker colored places are noticeably more compact and less altered than the lighter. They have evidently not been much influenced by the solutions which in more porous parts altered the rock and deposited native copper.

The thickness of the lode, as determined by mining operations, is from ten to twenty feet. There are some thicker and thinner parts. Near the surface at the Calumet mine the lode is about thirteen feet, at some levels at great depths at the Tamarack mine about twenty-two feet and at similar depths further south in the Hecla mine only about ten feet thick. The average thickness of the ore still to be mined is said to be about fifteen feet. The thickness sometimes varies considerably in short distances. According to Capt. Dariell, the thin portions "seem to occur in spots rather than in regular courses." As a rule the values are irregularly distributed from wall to wall. In places the poorest part of the lode is near the hanging wall, and there are places where the upper portion is the richest. In extensive workings tributary to one deep shaft the portion next the footwall was always the least productive.

At the Calumet mine the lode strikes N. 33° E. and

*Extracts from the writer's report to Michigan Geological Survey for the year 1911.

near surface dips to the N. W. at an angle of about 38°. At the South Hecla mine the dip at surface is 39°. At depth the angle of inclination is slightly less than at surface. One shaft, following the lode closely, is inclined at 38° down to the 36th level, and below that at 37° 30′.

The copper content of the conglomerate in the upper levels averaged 2% to 5% for a large output. In 1888, when the C. & H. mine was about 3,000 feet deep the ore mined yielded 4.5% copper. In 1900 the ore mined averaged 3% copper; but the workings below the 57th level in the northern part of the mine have yielded ore of much lower grade. The average for the Calumet and Hecla mine for 1910 was 30.12 pounds per ton, while the output of the Tamarack mine in the same year averaged 21.1 pounds copper per ton of ore.

In the mines blocks found to be low grade are left standing but aside from this there is little selection of the ore. Practically all the conglomerate broken in the stopes is hoisted and stamped.

The conglomerate lode has yielded more copper than any other on Keweenaw Point, and the metal has been won at a cost which has made the Calumet and Hecla the leading dividend producer among the mines of the world. The Tamarack mine has also a good record.

Mr. J. R. Finlay estimated in 1911 that the C. & H. had still on the conglomerate lode about 27,000,000 tons of ore, which should yield 26 pounds per ton—a total of 702,000,000 pounds copper. Another estimate in 1911 was 30,000,000 tons, 900,000,000 pounds. On account of great depth and lower values, the Tamarack portion of the lode gives little or no profit at low prices of copper.

The Kearsarge lode is the copper-bearing amygdaloidal upper portion of a bed of porphyritic melaphyre. The melaphyre near the lode is a dark grey or brownish ophite, with large phenocrysts of feldspar, usually greenish labradorite. The lode itself is commonly a brownish amygdaloid, with numerous and large amygdules of calcite, quartz, red feldspar and green epidote. Some copper occurs filling amygdules; but much of it is in irregularly shaped forms, which have evidently replaced the rock. Much of the copper is closely and probably genetically associated with epidote.

At Calumet the Kearsarge amygdaloid lies about parallel to the Calumet lode, having a strike N. 33° E. and a dip to the northwest of 38°. Further north the lode curves off more to the east.

Mining Osceola Amygdaloid Lode, Calumet and Hecla Mine, Mich.

The lode is several miles in length, and is being mined for a continuous stretch of five miles at the Centennial, South Kearsarge, Wolverine, North Kearsarge, Allouez, Ahmeek and Mohawk mines. Further north it has been opened up on the Gratiot, Seneca and Ojibway properties. Further south the lode has been opened up on the Calumet and Hecla, Laurium, Osceola and La Salle lands.

The ore mined on the five mile stretch from Centennial to Mohawk yields from 13 to 25 pounds copper per ton. The richest portions are at the Ahmeek, where the 1910 average was 22.3 pounds, and at the Wolverine, where the average for the fiscal year 1910-1911 was 24.75 pounds refined copper per ton of ore stamped. At

the Wolverine the ore is unusually uniform in grade and the percentage of rock broken and not stamped is very small.

Mr. Finlay estimated in 1911 that the five leading mines on the Kearsarge lode will produce 63,600,000 tons of ore, yielding 986,000,000 pounds of refined copper.

The Baltic lode is the upper portion of a melaphyre low down in the Keweenawan series. The amygdaloid has commonly grey or brownish groundmass, and amygdules of white calcite. The denser part of the bed, the footwall trap, is a brown melaphyre with abundant spots of green chlorite. The mineable copper is not confined to the amygdaloid, and frequently makes well down into the trap, thus making the lode very wide in places. Narrow veins carrying sulphides and arsenides are found in the lode, but are of no consequence as ore.

At the Baltic mine the lode strikes N. 60° E. and dips 73° N. W. The dip is much steeper than that on any of the other lodes, and consequently the method of mining is different, and will be described later.

The width varies commonly from 15 ft. to 60 ft. In some places the lode is mined for a width of 80 or 90 ft. The thickness is in most places greater than 20 ft. and averages about 24 ft.

Fissures are numerous in the lode, and at some of the mines faults and soft seams cut across it at short intervals. Many of the fissures are filled with calcite, making conspicuous, though usually very narrow, white veins, running across the dark rock. Many others are filled with soft greenish and reddish material, chloritic, talcose or clayey. These soft seams have apparently resulted from crushing and slipping. Often in such ground, the lode is displaced many times in a short distance.

In all the mines on the Baltic lode, the system adopted is to break the rock for the full width and sort out the poor rock and use it to fill in the stopes. The sorted ore from the different mines in 1910 yielded 17.95 to 26.6 pounds copper per ton. At the Superior mine much of the copper is unusually fine, and so disseminated that sorting is difficult. The ore mined at the Superior in 1910 averaged, however, 22.64 pounds per ton. At the other mines the ore is more readily selected from waste.

The lode has not yet been explored to any great depth, and its possibilities have yet to be determined. Mr. Finlay estimated in 1911 that the lode will produce about 15,000,000 tons of ore, containing about 311,000,000 pounds of copper. In this estimate he did not assume that the deposits will continue to very great depth, and if the values persist to depths found on the other great lodes, this estimate will, of course, be far exceeded.

The Pewabic lodes are the productive amygdaloids of the Quincy mine, and are now being opened up at the Franklin Jr.

Instead of a single lode, there is, at the Quincy, a zone about 300 feet thick in which there are several lodes. These vary considerably in different parts of the mine. For the most part they run parallel to one another and are separated by trap. In places they come together. There is commonly one of the lodes that is better than the other and is known as the "main" lode. As the workings are continued this main lode becomes in places quite subordinate in importance to one of the "east" or "west" lodes. What is known as the main lode in one part of the mine is not called the main lode in another part. In places there are four parallel lodes being worked at once.

The beds, of which the lodes are the amygdaloid portions, are a series of dark grey feldspathic lavas, porphyrites, known locally as the "Ashbed" series. The amygdaloid shows chlorite, calcite, epidote, quartz, prehnite and native copper in a dark brown or grey groundmass. The trap is a fine, but distinctly grained, dark grey, porphyrite, spotted with small patches of green chlorite. The copper occurs to some extent as a filling in cavities, but most of it has evidently replaced the rock, and forms irregularly defined masses, large and small. The larger masses, giving so-called "mass copper," are more abundant than in most of the lodes. While most of the copper is found in the amygdaloidal part of the bed, a large quantity is also mined from irregularly defined portions in the wall traps. The lodes are crossed by a number of persistent calcite veins, but these are usually barren and in parts of the lode that are poor.

At the Quincy mine, the main lode is on the average about 10 feet thick, varying from 3 to 15 feet. The inclination, as with most of the lodes, becomes less with depth—at the surface being 54°, and at the lowest levels, over one mile down on the slope, about 38°. This low angle of dip is not found in the southern part of the mine, but only in the bottom levels of the northern part. At the Franklin Jr. mine the dip varies from 49° at surface to 43° at the 32nd level. The lodes strike N. 30° E., and on the Quincy have a length of about three miles. Some of the lodes were not worked in the upper levels but were opened in cross cuts at lower levels and first worked extensively at a depth of nearly one mile down on the dip. They have since been worked for many levels above that at which they were first found to be good ore, and will be worked at comparatively shallow depth.

The Pewabic lode has produced at the Quincy over 600,000,000 pounds of copper. Some unusually rich ore was taken from the territory between No. 2 and No. 6 shafts, in the upper 20 levels. The ore mined in recent years has averaged about 16 pounds per ton. Mr. Finlay estimated in 1911 that the Quincy would produce 200,000,000 pounds more.

Osceola Lode.—This is a brown amygdaloid, spotted and streaked with white calcite, which has been worked by the Osceola, Calumet & Hecla and Tamarack mining companies. On these properties it has a length of about 3 miles. It underlies and runs parallel to the Calumet conglomerate, striking N. 33° E., and dipping at the surface at Calumet at an angle of 38°. The width varies from 15 ft. to 100 ft., the ore coming from two horizons, designated as hanging wall and foot wall parts. The chief and most regularly shaped ore body is found at the upper part of the bed. This hanging wall lode averages about 9 ft. in thickness and is fairly persistent and well defined. Below it is commonly dense brown melaphyre of varying thickness, succeeded by another amygdaloid, in which are irregular shaped ore bodies. The footwall deposits are often richer and thicker than those at the hanging wall, but they are of more pockety character, and do not persist so regularly with strike and dip. In some places dip and hanging portions are continuous, and there the lode is very wide, 40 to 100 ft. There is usually 10 to 20 ft. of the so-called "vein trap" separating them. The amygdaloid encloses numerous lenticular masses of dense trap. Often a bar of trap cuts across the amygdaloid, and it has been frequently noticed that the amygdaloid on opposite sides of such bars is unusually rich in copper.

The copper in the lode is rather regularly distribut-

ed, and in good rock readily detected. Hence, a satisfactory selection can be made before breaking, and practically all rock broken is hoisted.

Mr. Finlay estimated in 1911 the future production of the Osceola lode on Calumet and Hecla property, at 23,000.000 tons, yielding 330,000,000 pounds copper. The production for 1910 averaged 15.82 pounds per ton. The Osceola lode is very easily milled and smelted and produces copper of exceptionally high grade. Most of the copper from this lode is treated electrolytically for the recovery of silver.

Gold Quartz Veins, Hollinger Mine

ASBESTOS.

Supplying as they do a large proportion of the world's consumption of asbestos, the Canadian deposits of this mineral are of particular interest. While occurrences of the mineral have been noted in other localities and provinces, the principal areas are those found in the Eastern Townships, Province of Quebec. The present workable deposits are—as far as exploration work has shown, and with the exception of the Danville quarries—confined to the great serpentine range which strikes through the townships of Broughton, Thetford and Coleraine. Leaving some scattered deposits in the townships of Wolfstown and Ireland out of consideration, the total length of this productive serpentine belt is twenty-three miles, with a width varying from 100 feet in the extreme easterly part to 6,000 feet in the Mock Lake area; however, the serpentine belt as a whole in many places far exceeds the width indicated above. Active mining began about 1880.

The principal deposits occur at Thetford, Black Lake, Danville, and East Broughton; those at Thetford and Black Lake being the most important. The mineral occurs in a series of narrow and irregular veins, occasionally attaining a width of six inches, though those of the larger size are comparatively rare. Veins with three or four inches of fine fibre were, in the first years of working, quite plentiful; but as the mines increased in depth these appear to decrease somewhat in size. The veins reticulate through the rock in all directions. The deposits are worked by open quarrying, the long fibred asbestos of the larger veins being readily separated out, while the smaller material is carefully cobbed. This separation was at first accomplished entirely by hand, but mechanical treatment has been gradually introduced and perfected until now large mills are in operation in which the rock is broken and crushed in various ways; and the fiberized asbestos taken up from screens by suction fans, and blown into collectors or settling chambers.

The annual production is now over 100,000 tons, valued at upwards of $3,000,000; and includes a wide variety of grades from the long fibred crude asbestos, valued at $300 a ton, down to the shortest mill fibre, valued at only $2 or $3 per ton, and "asbestic" sand used for wall plaster, and valued at from 75c. to $1.50 per ton.

COBALT ORE AND BULLION SHIPMENTS.

(Cobalt Nugget.)

Thanks to the shipment of three cars of ore from the McKinley-Darragh immediately prior to the annual meeting on Monday, the ore shipments last week, were well maintained. The Cobalt Townsite also contributed quite materially with a couple of cars. The Dominion Reduction continues to ship low-grade concentrates, their car this week going to Carnegie.

But the bullion shipments continue to be under what they were last year. The Nipissing's annual clean-up at the high-grade mill is now completed, and from this time forward the bullion shipments should attain to normal proportions.

The shipments from the Cobalt camp for the week ending February 20th, were:—

	High.	Low.	Tonnage.
Dom. Red.		87,900	87,900
Nipissing		132,040	132,040
McKinley-Darragh	203,810		203,810
Hudson Bay	86,160		86,160
La Rose	84,520		84,520
Cob. Townsite.	173,980		173,980
O'Brien	60,160		60,160
	608,630	219,940	828,570

The bullion shipments for the week ending February 20th, were:—

	Bars.	Ozs.	Value.
Dom. Red.	31	35,061.00	$21,984.77
Nipissing	26	31,754.76	18,338.37
Kerr Lake	3	2,266.00	1,162.00
	60	69,081.76	$41,485.14

BOOK REVIEWS

THE COPPER HANDBOOK—Vol. XI.—1912-1913—by Walter Harvey Weed—Mining World Co.—Price $5.00—for sale by Book Department Canadian Mining Journal.

This work, founded by the late Horace J. Stevens, of Houghton, Mich., has for some years been the standard work on copper mines. The new edition has been entirely written by Mr. Weed, a recognized authority on copper mining. A new feature is a geographical index, which gives at a glance the names of all mining companies operating in or near any town. The "dead" companies are separately listed.

The greater part of the book, as in former editions, is devoted to description of the copper mines of the world, and information concerning company holdings, officials, finances, costs, mine output, nature of ore, geology and methods of mining, milling and smelting. Plants are described. Predictions are made as to the future.

The work is in five parts, headed as follows: Detailed description of the copper mines of North America, including Canada, United States and Mexico; Geographical Index; Detailed description of the copper mines of foreign countries; Statistics; List of dead, merged, liquidated mining companies.

Mr. Stevens gathered and digested a great mass of information concerning copper mining companies in all parts of the world. In his Copper Handbook he gave this information in concise form. Mr. Weed has in revising the work drawn on a fund of technical knowledge, particularly of the mining districts of the United States.

THE MINING MANUAL AND MINING YEAR BOOK 1914—by Walter R. Skinner—Price $5—For sale by Book Department Canadian Mining Journal.

This volume is the twenty-eighth of the series. The first was published in 1887. The work is classified into two sections—"African" and "Miscellaneous." While most of the mines listed are those whose shares are dealt in on the London market, there are many others. Particulars are supplied of 2,620 companies, and the Index gives references to 5,220 companies.

In most cases an analysis of the last balance-sheet is provided. A statement is made of dividends from inception, ore reserves, output, description and capacity of plant, results of exploration, etc.

Alphabetical lists of mining directors, secretaries, engineers and mines managers, with their addresses and the names of the companies with which they are connected, is included.

The work has been for years a standard reference on mines. The 1914 edition brings it up-to-date.

THE ELECTRIC FURNACE—by Alfred Stansfield, D.Sc., Birks Professor of Metallurgy in McGill University—Second Edition, Revised, Enlarged and Reset—McGraw-Hill Book Co., 1914—Price $4—For sale by Book Department Canadian Mining Journal.

The first edition of this book was published in 1907. During the past few years development has been rapid, and the new edition is much larger by the inclusion of new material.

The chapter headings are: History of the electric furnace; Description and classification of electric furnaces; Efficiency of electric and other furnaces and relative cost of electrical and fuel heat; Construction and design, operation of electric furnaces; Laboratory furnaces; The production of pig iron in the electric furnace; The production of steel from metallic ingredients; The production of steel from iron ore; The ferro alloys and silicon; Graphite and carbides; The electric smelting of zinc and other metals; Miscellaneous uses of the electric furnace; Electrolysis and electrolytic processes; Future developments of the electric furnace.

The author endeavors to trace the evolution of the electric furnace from its simplest beginnings, and to set forth the more important facts relating to its theory and practice. He believes that while a few years ago it was a scientific curiosity, it now threatens to rival the Bessemer converter, the open-hearth steel furnace, and even the blast furnace itself. The book is well written, well illustrated and well printed.

DOMINION STEEL AND COAL.

Feb. 23.—"The improvement in the steel industry in Canada has not been nearly as rapid as we had expected early in the winter and the improved conditions which we had looked for with the coming of spring may be withheld until the summer."

This was the view expressed by Mr. J. H. Plummer, President of the Dominion Steel Corporation, while in Montreal on Saturday en route from Sydney to Toronto.

"Orders have neither been as large or as numerous as we had expected, and while the steel plant is working on about two-thirds time, the only work being done is on rail orders and these are almost solely for export business," explained the Steel President.

Referring to the coal business, Mr. Plummer said that there had also been a noticeable falling off in this business during the present winter and at the present time the mines were engaged in mining for next summer's orders.

Speaking of the reported sale of a large quantity of ore from the Wabana Mines, Mr. Plummer said negotiations had been entered into for the sale of a quantity of this ore, but he was unable to estimate what the profits, resulting from the sale, would be.

Mr. Plummer is leaving in March for England. He said that it was purely a vacation and not for any business connected with the company. In some quarters his projected visit abroad was associated with the intention of marketing the unsold portion of their authorized note issue.—Montreal Star.

NIPISSING.

Cobalt, Feb. 25.

A new bullion record for the Cobalt camp was established to-day, when the Nipissing mines shipped nearly 13 tons of silver, valued at more than a quarter of a million dollars, in 381 bars. The shipment contained 452,335.87 ounces, and was valued at $260,681.16. It goes by train to Halifax, and leaves by the Alsatian from that port for England on Saturday morning.

The camp's previous record was established in January of last year, when 265 bars were shipped during the week by several companies in camp, and at that time Nipissing led with nearly 200 bars.

PERSONAL AND GENERAL

President A. E. Barlow and Secretary H. Mortimer-Lamb represented the Canadian Mining Institute at the A.I.M.E. banquet on Wednesday, Feb. 18th.

Mr. W. E. Segsworth has returned to Toronto from London, England.

Mr. J. B. Tyrrell attended the annual A. I. M. E. meeting in New York, and has returned to Toronto.

Mr. W. W. Mein has returned to New York, after spending two weeks at Porcupine.

Mr. F. H. Hatch is in Canada to examine properties at Kirkland lake for the K. L. Exploration Co.

Mr. Eugene Coste, of Calgary, was in New York last week, and presented a paper on Origin of Petroleum, at the A.I.M.E. annual meeting.

Mr. W. P. Alderson, general manager of the Motherlode Sheep Creek Mining Co., operating a gold mine and stamp-mill in the Sheep Creek region of Nelson mining division, left British Columbia last month, on a visit to Montreal.

Mr. J. J. Fingland, of Kaslo, B.C., has been appointed assistant assayer in connection with the experiments in electric smelting of lead-zinc ores being carried on at Nelson, B.C., under the direction of Mr. G. C. Mackenzie of the Mines Branch, Canada Department of Mines.

Capt. Harry Johns, superintendent of several mines of the British Columbia Copper Co., operating in Nelson and Slocan mining divisions, British Columbia, has gone to California to recuperate after a serious illness with pneumonia.

Mr. Frederic Keffer is back in the Boundary district of British Columbia from a visit to Cleveland, Ohio, and New York City, N.Y.

Mr. Arthur Lakes, Jr., manager for the Ymir-Wilcox syndicate, which for about two years has been developing the Wilcox mine, near Ymir, B.C., has been spending a winter vacation in California.

Mr. Robert C. Sticht, recently arrived at Vancouver, B.C., from Tasmania, where for some years he has been general manager for the Mount Lyell Mining & Railway Co. He did not remain on the coast, but at once proceeded East.

Mr. John Shanks, of Fernie, B.C., has resigned as colliery manager for the Crowsnest Pass Coal Co., to accept a position with the Brazeau Colliery Co., having extensive coal-land holdings situated in western Alberta.

Dr. Otto Sussman, of New York, has been on a visit to West Kootenay, British Columbia, whence he went to Butte, Montana.

Mr. R. E. Hore has returned to Toronto from New York, where he attended the A.I.M.E. annual meeting.

Mr. R. Randolph Bruce, of Invermere, East Kootenay, B.C., was married in England, in January, to Lady Elizabeth Northcote. He is well known in British Columbia, having resided in the vicinity of the head of the Columbia river for about 16 years. He was manager of the Paradise mine, in Windermere mining division, when that property was being worked some years ago.

Mr. Geo. B. Burchell, former general manager of the Maritime Coal Ry. & Power Co., of Nova Scotia, has opened an office in the McGill Building, 211 St. James street, Montreal. Mr. Burchell, who is a graduate of McGill University, has spent the last 14 years in colliery management in Eastern Canada. He recently returned from Europe, where he has been carrying on certain mining investigations for the Saskatchewan Government.

Mr. Roscoe Wheeler, superintendent of the Hedley Gold Mining Company's 40-stamp mill and cyanide plant in Similkameen district, British Columbia, who last month returned from a month's visit to California, has been recalled to that state, owing to the serious illness of his mother.

Mr. A. J. Young has been elected Chairman of the Associated Boards of Trade of Ontario.

Mr. R. R. Shafter, formerly sales engineer of the Traylor Engineering & Manufacturing Co., of New York, has recently been appointed manager of the mining, crushing and cement machinery department of the Jenckes Machine Company, with headquarters at Sherbrooke. Mr. Shafter is a graduate of Stephen's Institute and a member of the American Society of Mechanical Engineers. He is bringing with him to the Jenckes Machine Company several engineers who are experts in the construction and installation of mining machinery and are thoroughly familiar with the class of work Mr. Shafter had charge of in his former position.

Mr. J. H. Plummer has returned to Toronto after visiting the Nova Scotia properties of the Dominion Coal and Steel Companies.

Mr. J. H. Fairbank, of Petrolea, Ont., well-known as an oil producer, died last week in his 83rd year. He was for over 50 years prominent in the oil industry.

Mr. A. A. Hassan has concluded an examination of placer gold deposits in Arizona and returned to Brooklyn, N.Y.

Herbert Morris, Limited, has just received from the London and North Western Railway Company, an order for ten 10-ton hand overhead traveling cranes and two electric cranes. This, together with an order for eight 12-ton hand-cranes, from the London and South Western Railway Company, makes the largest contract of the kind that has been placed for some years past.

NEW HOIST FOR BEAVER MINE.

Cobalt, Feb. 25.

The new hoist of the Beaver Consolidated mines, which will hoist from a depth of 2,000 ft., has arrived in camp, and is now being unloaded from the car at the Kerr Lake station. The hoist is the largest one in camp, and will permit the policy of deep mining planned by the company some months ago. As soon as the hoist is installed at the mine, work will immediately start in sinking below the present levels.

For some months past no work has been done on either the 700 or 800-ft. levels because the hoist at present in use at the mine would not accommodate these levels satisfactorily. Several hundred feet of drifting was done at 700 ft. with good results, but at 800 ft. work accomplished did not reach the ore shoot on the main level. The work on both these low levels will immediately be resumed once the new hoist is running at the mine, and, in addition, drills will start sinking to open a level at 900 ft. Levels will be opened each 100 ft. on the way down and the favorable development of each level will mean additional depth to the property.

SPECIAL CORRESPONDENCE

COBALT, ELK LAKE AND GOWGANDA

Nipissing.—In view of the sudden recession in the position of Nipissing, the monthly report was of especial interest. The production was $186,459—much less than usual—but this is explained by the fact that this is the month of the annual clean-up at the high grade mill. Only 22 tons were treated there during the month. Structural improvements were also a contributing cause to the relatively small output at the high grade mill during the month. No new veins were actually encountered during the month, but some finds made in the previous month are reported to be developing finely. At the present time the drift face on the Meyer vein, which has a total length on four levels of over 1,100 ft., show three veins averaging 2,000 oz. over a width of 1 in. and one vein assaying a like amount 2 to 4 in. wide. The Meyer vein, which follows the contact with the Keewatin formation down, will contribute good ore for a hundred feet above the contact between the Trethewey boundary and the east face of the drift on the fourth level. The mill ore, apart from the high grade, runs about 20 oz. across 15 ft. In the crosscuts from shaft No. 73 new veins were found. At shaft 64 drifting was continued on the new vein encountered on the third level two months ago. During most of the month the west drift showed two in. of ore averaging 2,000 oz. This vein has now been drifted on at this level for a distance of 150 ft., and will average 1½ inches wide, and will assay 1,800 oz. Work on the original cross-cut, which is to connect shafts 73 and 64, has been resumed. The connection has now almost been made.

On the other side of the lake most of the work was confined to the Little Silver vein. The vein was stoped from the 24 ft. level, producing high grade ore assaying 2,500 oz. over a width of two in. A branch vein over a width of two in. is producing 500 oz. ore. During the month the low grade mill treated 6,023 tons.

The diamond drill has now been moved to the southern shore of Peterson lake, where more interesting results are anticipated.

Peterson Lake.—The discovery on the Peterson Lake property was made from the old shaft of the Kerry lease, which some time ago reverted to the Peterson Lake Mining Company. The old crosscut on the Kerry was used for 200 ft. south of the shaft, when work was commenced in an old drift 100 ft. away from the crosscut to the east. This drift was on a vein showing plenty of cobalt, but very small silver values. It was entirely in the Keewatin formation. Twenty or thirty feet of work carried the company into conglomerate rock, when almost at once the high grade ore was struck. There are two veins in the drift, and it is stated that the wall rock will make good milling ore. Drifts will be driven on both veins. A crosscut will also be commenced from the old St. Anthony lease to connect with the present drift from the old Kerry. A very extensive scheme of development had been planned by the Peterson Lake. It is intended to connect the shaft at the Narrows with No. 1 shaft of the Kerry and the No. 1 shaft with the main workings of the Kerry and crosscuts to that end have already been commenced. It is remarkable that before the Seneca-Superior took over the lease on Cart Lake, the Kerry Mining Company had it, as they also held the lease on Peterson Lake, where the strike has now been made.

On the Porcupine Winter Trail in 1910

Trethewey.—The outstanding feature of the annual report of the Trethewey Silver Cobalt mine is that while ore reserves stand almost where they did a year ago the net silver produced amounted to $333,611, while the gross revenue for the year was $334,769. The operating expenditures amounted to $204,072, leaving a net revenue from operations of $130,696, as compared with $127,834. This must be regarded as very satisfactory, since the high grade days of the Trethewey are over.

Dividends paid during the past year amounted to $150,000, and after all provision had been made, the surplus carried forward to the current year was $146,148.

The report of Mr. D. L. H. Forbes, consulting engineer for the property, showed that the total amount spent on development during the year was $37,686, for which a total footage of 20,984 was made.

The estimate of silver in the ore reserves was 29,-928 tons, containing 585,970 oz.

To make the mill more efficient $5,598 was spent, and as a result the tonnage milled was 32.1 per cent. greater and the cost 25.2 per cent. less.

The total silver produced was 619,427 oz., but of this only 599,035 oz. were shipped.

An operating profit of $130,696, or $3.70 per ton, was made during the year. From this had to be deducted $3,757 spent on exploration work at the West Beaver mine, and the net profit for the year was $126,939.

Of the prospect taken up near Port Arthur—the West Beaver mine—it is stated that the property is being worked on a working option basis. The vein is stated to be three ft. wide, 26 ft. below the adit level, and not sufficient work has been done yet to block out any ore or to warrant any estimate of ore in sight.

A New Mineral.—T. L. Walker, professor of Mineralogy at the University of Toronto, announces that he has discovered a new mineral in some ore samples from the Moose Horn mine at Elk Lake, and he has named it "Temiskamite." It was sent to the royal Ontario Museum of Mineralogy as niccolite, but is in reality much paler in color. It occurs in calcite veins carrying niccolite and smaller amounts of native bismuth and silver.

City of Cobalt.—A discovery of considerable importance has just become generally known on the City of Cobalt. A vein of very high grade ore has been cut near the Coniagas boundary at the 200 ft. level. Twenty stamps are now dropping on City of Cobalt ore at the Cobalt reduction mill. Most of this ore is coming from No. 14 vein at the 400 and 330 ft. levels.

Reeves-Dobie.—A Toronto syndicate has taken a 90-day option on Mr. S. J. Dobie's half interest in the Reeves-Dobie claims at Gowganda. They will commence work at once.

Beaver.—High grade silver is being mined in granite at the 460 ft. level of the Beaver mine. The granite is an intrusion in the Keewatin. In the 15 ft. the drift has been pushed the vein will average from four to six in., and will probabaly average 3,000 oz. to the ton.

This is the first time that silver has been discovered in granite in the camp.

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

Dome Lake.—The report of the new manager of the Dome Lake mine, submitted to shareholders at the annual meeting, stated in regard to ore reserves that there were two ore shoots on the 180 ft. level, one 60 ft. long, of an average width of 20 in., assaying $17.96, the second 50 ft. long of an average width of 20 in. assaying $18.80 per ton. The ground between the two ore shoots will be productive. On the 150 ft. level one lens has been drifted on for 100 ft. of vein matter, carrying an average assay of $22.80 per ton. The ore still shows in the face of the drift.

Mr. A. H. Brown plainly intimates that previous work was not well directed. Although 4,646 ft. of work had been done, only 926 ft. was in ore. The greater portion of the drifting and crosscutting had been run in the most erratic manner.

As to the mill it was not proposed to go to the expense of making alterations until the mine had been developed sufficiently to allow of an estimate of the tonnage and grade of ore to be made.

The average value of ore sent to the mill was $8,976. The lower value shown was largely due to the fact that much waste went to the mill, there being no facilities provided for picking the same before it went to the mill. The mill crushed 3,717 tons of ore in the three months it was operated, during which time there was recovered $25,369.

Mr. A. H. Brown is hopeful that six months' work will develop sufficient ore to enable the mill to be operated continuously on a 50 ton a day basis, and that the ore should be a much better grade than treated in 1913.

The directors decided to raise the capitalization to $1,000,000, and offer the 250,000 extra shares at 30 cents a share. It was also decided to move the head office from Toronto to New Liskeard, where the bulk of the stock is now held.

More Kirkland Lake Claims Sold.—Several more sales are reported of Kirkland Lake claims to English syndicates. Perhaps the most important of these is that of the Kirkland Lake Gold Mines, in which Mr. A. G. Bagshaw, J. H. Black and other Haileybury men are mainly interested. Satisfactory terms have been offered, and Mr. W. A. Gordon, of Haileybury, has left for London to complete the deal.

Dome.—According to statistics submitted, the average value of Dome ore for the past ten months has been $8.86. This compares with $8.02 for January. The month of January showed an all round improvement in the tonnage milled and the gold per ton recovered. Since April of last year the Dome reports 118,230 tons milled, gold recovered $1,047,606.

Dane.—In the month of January shipments from the Dane Mining Company were resumed. Three shipments from Dane station were made of copper ore, in all totalling 132,900 lb. From South Porcupine 69,000 pounds of gold ore was shipped from the Porphyry Hill property. This ore is coming from an open cut on the old claims of the Preston East Dome, which reverted to and are now being worked by the original owners.

Alexo—The little nickel mine near Porquis Junction known as the Alexo mine, continues to make very considerable shipments. During the month of January alone twenty cars were shipped, carrying in all 1,489,-350 lb. to the new Mond Nickel Company's smelter at Coniston, Ont.

BRITISH COLUMBIA

In the chief producing districts, of lode metals and coal, there is much activity. The year has opened auspiciously, and the outlook at present is favorable to a year of large production, and of profit-earning to a greater extent than in 1913, which year was the best from a dividend-paying point of view the mines of the Province have had for a comparatively long time.

Trail.

Consolidated Mining & Smelting Co.—Statistics now available show that the total quantity of ore and concentrates received at the Consolidated Mining and Smelting Co.'s smeltery at Trail during the calendar year 1913 was 353,502 tons gross, or 348,201 tons net.

The production of metals was as follows: Gold, 149,946 oz.; silver, 2,860,890 oz.; lead, 48,495,694 lb.; copper, 2,613,568 lb. of that quantity of ore, 23,558 tons was from Washington and Idaho mines; this yielded 14,667 oz. of gold, 160,313 oz. of silver, 195,037 lb. of lead, and 354,105 lb. of copper. The Washington mines that shipped to Trail were as follows: Republic camp —Ben Hur, 16,542 tons; Knob Hill, 1,442 tons; Lone Pine, 924 tons; Hope, 912 tons; Surprise, 485 tons; Imperator-Quilp, 196 tons; miscellaneous, 9 tons; total from Republic, 20,510 tons. Other Washington mines —United Copper at Chewelah, 2,076 tons; Bononza at Evans, 575 tons; four smaller shippers, 44 tons; total for Washington, 23,205 tons. Idaho shipments totalled 353 tons, chiefly from the Snowstorm mine, Larson.

British Columbia mines shipped 329,944 tons of the before-mentioned total. This came from the districts as follows: East Kootenay, 34,571 tons; Ainsworth, 14,974 tons; Slocan, 21,569 tons; Nelson, 12,084 tons; Rossland, 240,442 tons; Lardeau and Trout Lake, 557 tons; Boundary, 4,807 tons; Kamloops and Nicola, 612 tons; Coast, 328 tons.

The proportion from the company's own mines was 267,940 tons, or 75 per cent. of the total; this included Centre Star-War Eagle and Le Roi groups at Rossland 218,164 tons, St. Eugene and Sullivan in East Kootenay district 34,355 tons, No. 1 and Highland in Ainsworth camp 5,147 tons, Molly Gibson and Silver King in Nelson mining division 4,737 tons, No. 7 in Boundary district, 4,594 tons, and Ottawa and Richmond-Eureka in Slocan district 943 tons. Custom ores totalled 85,562 tons—23,558 tons from the United States, as detailed above, and 62,004 tons from British Columbia mines. Shippers of more than 200 tons each were as follows: Ainsworth division—Bluebell (concentrate), 7,209 tons; Silver Hoard, 1,286 tons; Utica, 626 tons; J. L. Retallack & Co.'s Whitewater group, 517 tons. Slocan division—Standard (ore and concentrate), 14,390 tons; Rambler-Cariboo (ore and concentrate), 3,160 tons; Van Roi (concentrate), 584 tons; Slocan Star, 479 tons; Ruth, 470 tons; Eastmont, 336 tons; Idaho-Alamo, 275 tons; Silverton Mines, Ltd. (Hewitt-Lorna Doone mines), 232 tons; Surprise, 221 tons. Nelson mining division—Yankee Girl, 3,034 tons; Emerald, 1,149 tons; Queen (gold ore concentrate), 608 tons. Rossland mines—Le Roi No. 2 Co.'s Josie group, 22,002 tons (first-class ore, 20,359 tons and concentrate 1,643 tons); Lardeau-Ferguson Mines, Ltd., 525 tons. Kamloops—Iron Mask, 585 tons. Skeena district (Coast)—Silver Standard, 282 tons. In all 103 mining properties shipped to Trail, as follows: From East Kootenay 4, Ainsworth 12, Slocan 31, Nelson 14, Rossland 8, Lardeau 5, Boundary 7, Kamloops 1, Nicola 1, Skeena district 5, United States 15.

Kamloops.

The Kamloops Copper Co., of Duluth, Minnesota, after having for some time held the Iron Mask group without doing work on it, during 1913 shipped ore from the Erin claim of the group and put in electrically operated machinery to run the plant at the Iron Mask 600-ft. shaft. There was received at Trail from this property in 1913 585 tons of ore, and it is expected that a larger output will be made after the new machinery shall be in use and it shall be practicable to resume mining in the Iron Mask mine.

Mr. W. M. Brewer, who spent some time in Kamloops mining division investigating mining conditions, says: "On the North Thompson river, some deposits of gold-bearing quartz were opened during the year which may be developed into successful mines; as these locations are situated near the Canadian Northern Railway, they are easy of access. On the Cotton Belt group, in Seymour Arm camp, some of the ores contain copper in a quartz gangue and others galena in a magnetite gangue. These locations at present are handicapped by lack of transportation facilities. Some

Mount Robson, B.C.

prospecting was done during the past summer on Louis creek, a tributary of the North Thompson, and it is claimed that about $8,000 in placer gold was recovered by individual miners. The bedrock is deep and only exposed at one point. This creek was worked for gold as early as 1862."

Lillooet.

In the Bridge River section of Lillooet district the most important recent development was that of the Coronation Gold Mines, of Victoria, which company, after having acquired the Ben d'Or property and having done a lot of underground work, repaired the old 10-stamp mill and crushed 840 tons of ore, from which was recovered 1,368 oz. of gold and 295 oz. of silver, beside 20 tons of concentrate stored for shipment later. A few men have been kept employed through the winter sinking a winze from the lowest tunnel (No. 4).

	1911-1912.	1912-1913.
From free miners' certificates..	$ 68,101.21	$ 62,985.70
From mining receipts, general..	93,461.70	94,754.35
From mineral tax	100,659.29	155,163.36
From royalty and tax on coal..	195,207.78	302,225.35
From unworked Crown-granted mineral claims	43,436.00	42,733.43
From Bureau of Mines	662.50	863.00
	$501,528.48	$658,725.19

HOLLINGER.

The regular twenty-eight-day statement of the Hollinger Gold Mines, Limited, for the period ending January 28 shows a decrease in the gross profits to

Members of C2 Excursion, on Grand Trunk Pacific near Swiftwater, B.C.
Mount Robson in the Background.

The Pioneer mine, also on Cadwallader creek, has been examined and sampled for the owners, and some development work is being done. The completion of a wagon road from Seton lake to the Pioneer has made it practicable to work mineral claims on Cadwallader at much less cost than when everything had to be packed in to the properties.

Not much placer mining was done last season, though the Golden Dream Co. did some prospecting on its leases on Cadwallader creek. Some ground-sluicing was done with the object of exposing the leads on the Blackbird claim, and a crosscut was driven 100 ft. to one vein and about 100 ft. of drifting done on it.

Victoria.

The Public Accounts of the Province show that the revenue for the last two fiscal years included the following from mining:

$101,603, as compared with $114,000 in the previous period. The average value of ore hoisted shows a decrease from $16 to $13.57 per ton, but there was a small reduction in working costs. The profits of the Hollinger mine have been decreasing steadily for some months owing to the development work now in progress, and the fact that the grade of ore hoisted has been steadily lower.

The present report is signed by Mr. A. R. Globe, the assistant general manager, Mr. P. A. Robbins, the manager, being at present on a holiday abroad.

It is stated in the report that during the period covered 1,179 ft. of diamond drilling was accomplished, locating one new ore body on the 425-ft. level and on the 200-ft. level. General development amounted to 817 ft. In the month 2,912 tons were taken from development and 9,943 tons from the stopes.

MARKETS

STOCK QUOTATIONS.

New York Curb.

Quotations and transactions on the New York Curb reported by Erickson, Perkins & Co. (J. G. Beaty), are as follows:

	Feb. 24, 1914. Bid.	Ask.
Buffalo	.01 1/16	.01 7/8
Dome Mines	.16 3/4	.17 1/2
Foley-O'Brien	.15	.20
Granby	.85 1/2	.86
Hollinger	.17	.17 1/2
Kerr Lake	.04 15/16	.05
La Rose	.01 1/16	.01 15/16
McKinley	.01 3/16	.01 1/4
Nipissing	.06 3/8	.06 1/2
Rea Cons.	.00 1/8	.00 1/4
Preston	.01	.02
Pearl Lake	.09	.11
Silver Leaf	.01	.03
Silver Queen	.01	.03
Swastika	.08	.12
Porcupine Gold (Vip.)	.02	.05
Trethewey	.28	.30
Yukon Gold	.02 1/2	.03 3/4

Porcupine Stocks.

(J. P. Bickell & Co.)

	Feb. 23. Bid	Ask.
Apex	.01 7/8	.02
Dome Extension	.10 3/4	.11
Dome Lake	.34	.35
Dome Mines	12.00	17.25
Foley-O'Brien	.16	.18
Hollinger	16.80	17.00
Jupiter	.12 1/2	.13
McIntyre	1.30	1.35
Moneta	.02	.04
North Dome	.20	.25
Northern Exploration	2.80	3.00
Pearl Lake	.09 3/4	.10
Plenaurum	.45	.60
Porcupine Gold	.13 1/2	.14
Imperial	.02 1/4	.02 1/2
Porcupine Reserve	...	.06
Preston East Dome	.02	.02 1/8
Rea	.15	.25
Standard	.01	.01 1/2
Swastika	.04	.04 1/4
United	.01	.01 1/2
West Dome	.09	.10
Porcupine Crown	1.27	1.30
Teck Hughes	.20	.30

Cobalt Stocks.

(J. P. Bickell & Co.)

	Feb. 23. Bid	Ask.
Bailey	.05	.05 1/4
Beaver	.29	.30 1/2
Buffalo	1.80	2.00
Canadian	...	.10
Chambers Ferland	.21	.22 1/2
City of Cobalt	.40	.50
Cobalt Lake	.68	.72
Coniagas	7.90	8.25
Crown Reserve	1.80	1.84
Foster	.10	.10 1/2
Gifford	.03	.03 1/2
Gould	.03	.03 1/4
Great Northern	.14	.14 1/4
Hargraves	.02	.02 1/2
Hudson Bay	71.00	73.00
Kerr Lake	4.80	4.90
La Rose	1.72	1.75
McKinley	1.19	1.20
Nipissing	6.40	6.50
Peterson Lake	.41	.41 1/2
Right of Way	.06	.06 1/2
Rochester	.03	.03 1/4
Leaf	.02	.02 1/2
Cochrane	...	.40
Silver Queen	.04	.05
Timiskaming	.22	.22 1/2
Trethewey	.25	.28
Wettlaufer	.05	.07
Seneca Superior	2.85	3.00

TORONTO MARKETS.

Feb. 24.—(Quotations from Canada Metal Co., Toronto):
- Spelter, 5 1/4 cents per lb.
- Lead, 5 1/4 cents per lb.
- Tin, 41 cents per lb.
- Antimony, 8 1/2 cents per lb.
- Copper, casting, 15 1/2 cents per lb.
- Electrolytic, 15 1/4 cents per lb.
- Ingot brass, 10 to 15 cents per lb.

Feb. 25.—Pig iron—(Quotations from Drummond, McCall & Co., Toronto):
- Summerlee No. 1, $26.00 (f.o.b. Toronto).
- Summerlee No. 2, $25.00 (f.o.b. Toronto).

Feb. 25.—Coal—(Quotations from Elias Rogers Co., Toronto):
- Anthracite, $8.25 per ton.
- Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

Coke.

Feb. 20.—Connellsville Coke (f.o.b. ovens):
- Furnace coke, prompt, $1.90 per ton.
- Foundry coke, prompt, $2.40 to $2.60 per ton.

Feb. 20.—Tin, straits, 39.25 cents.
- Copper, Prime Lake, 14.80 to 15.00 cents.
- Electrolytic copper, 14.55 to 14.65 cents.
- Copper wire, 15.75 to 16.00 cents.
- Lead, 4.00 cents.
- Spelter, 5.40 to 5.50 cents.
- Sheet zinc (f.o.b. smelter), 7.25 cents.
- Antimony, Cookson's, 7.25 cents.
- Aluminum, 18.50 to 18.75 cents.
- Nickel, 40.00 to 45.00 cents.
- Platinum, hard, 10 per cent., $46.00 to $47.50 per oz.
- Paltinum, hard, 20 per cent., $49.00 to $51.50 per oz.
- Platinum, soft, $43.00 to $44.00 per oz.
- Bismuth, $1.95 to $2.15 per lb.
- Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York. cents.	London. pence.
Feb. 10	57 1/2	26 9/16
" 11	57 1/2	26 9/16
" 12	..	26 5/8
" 13	57 3/8	26 1/2
" 14	57 3/8	26 1/2
" 16	57 3/8	26 1/2
" 17	57 3/8	26 1/2
" 18	57 3/8	26 1/2
" 19	57 1/2	26 9/16
" 20	57 1/2	26 9/16

STANDARD MINING BOOKS

Ore Dressing

By Robert H. Richards, S.B., LL.,D.,

Professor of Mining and Metallurgy, Massachusetts Institute of Technology.

Four Volumes, 2,000 pages, 6x9, illustrated. Per set, $20.00 (£4, 4s) per volume, $5.00 (2/2.)

An Encyclopedia on the Dressing of Minerals. Volumes I and II, published in 1903, covered the practice of the world to that date with the underlying principles and unchanging data. Volumes III and IV supplement, but do not supplant the earlier work. The fresh material—tube mills, Wilfley tables, magnetic separation, flotation processes, etc.—required two new volumes.

Plant equipment, comparative efficiency, costs of operation, speed, capacity, water power, life of Machines, etc., are covered in great detail. Index to all four volumes bound separately, supplied free with complete sets or Volumes II. and IV. when sold together.

Vols. I. and II.

CONTENTS.—Chapter I.—General Principles. Part One—Breaking, Crushing and Comminuting. Chapter II.—Preliminary Crushing. III.—Rolls. IV.—Steam, Pneumatic and Spring Stamps. V.—Gravity Stamps. VI.—Pulverizers Other Than Gravity Stamps. VII.—Laws of Crushing. Part Two—Separating. Concentrating or Washing. Chapter VIII.—Preliminary Washers. IX.—Sizing Screens X.—Principles of Screen Sizing. XI.—Classifiers. XII.—Laws of Classifying by free settling in water. XIII.—Hand Picking. XIV.—Jigs. XV.—Laws of Jigging. XVI.—Fine Sand and Slime Concentrators. XVII.—Amalgamation. XVIII.—Miscellaneous Processes of Separation. Part Three—Chapter XIX.—Accessory Apparatus. Part Four—Mill Processes and Management. Chapter XX.—Summary of Principles and Outlines of Mills. XXI.—General Ideas on Milling. Appendix.

Vols. III. and IV.

Chapter XXII.—General Principles. XXIII.—Preliminary Crushing. XXIV.—Rolls. XXV.—Steam, Pneumatic and Spring Stamps. XXVI.—Gravity Stamps. XXVII.—Pulverizers Other Than Gravity Stamps. XXVIII.—Laws of Crushing. XXIX.—Preliminary Washers. XXX.—Sizing Screens. XXXI.—Principles of Screen Sizing. XXXII.—Classifiers. XXXIII.—Laws of Classifying by Settling in Water. XXXIV.—Hand Picking. XXXV.—Jigs. XXXVI.—Laws of Jigging. XXXVII.—Fine Sand and Slime Concentrators. XXXVIII.—Amalgamation. XXXIX.—Miscellaneous. Processes of Separation. XL.—Accessory Apparatus. XLI.—Summary of Principles and Outlines of Mills. XLII.—General Ideas on Milling. Appendix. Index.

Issued January 6, 1912.

Stamp Milling

By Algernon Del Mar, Mem. A.I.M.E., etc.
134 *pages*, 98 *illustrations*, $2.00 (8/6).

A new treatise by a writer with a broad, practical experience.

Algernon Del Mar has been connected with the construction and operation of mills of all sizes in both the United States and foreign countries. He describes South African as well as "Western" practice.

He gives complete modern data, supplemented by a series of excellent illustrations.

CONTENTS: Evolution of the Gravity Stamp Mill. General Principles of the Stamp Mill. Practical Working of the Stamp Mill. Limitations of the Single Unit and Five-stamp Unit Batteries. History of Amalgamation. Amalgamation. Stamp Mill Construction.

Second Edition; Total Issue, 6,000.

Metallurgy of Iron and Steel

By Bradley Stoughton,
B.S., Ph.B.
Consulting Engineer.
537 *pages*, 370 *illustrations*, $3.00 (12/6).

A new edition, completely revised and enlarged—of the standard work. It covers the latest developments.

Among the important changes where entirely new matter is presented are those on the manufacture of pig iron; fuels; Bessemer, open-hearth processes, special open-hearth and duplex processes; malleable cast iron; heat treatment; electro-metallurgy.

Mining without Timber

By R. B. Brinsmade.
309 pp., illustrated.
$3.00 (12/6).

A timely and valuable book. Gives the best American practice, from leading mining centres.

Among the methods described are: Surface Shovelling in Open Cuts; Surface Mining; Underhand and Overhand Stoping with Variations; Back Caving; Block Caving; Slicing; Advancing Long Wall for Seams; Pillar Systems for Seams; Flushing System for Seams.

Second Edition.

Manual of Fire Assaying

By Charles H. Fulton,
E.M., D.Sc.
Prof. of Metallurgy, Case School.
219 *pages, illustrated*, $2.00 (8/6).

A new edition—thoroughly revised, reset and enlarged.

It covers all the recent progress and is up to date throughout.

Especially valuable is the new material on assay furnaces, assay fluxes, cupellation, and special methods of assay.

Design of Walls, Bins and Grain Elevators

By Milo S. Ketchum,
University of Colorado.
Second Edition; Fully Revised.
556 *pp., illustrated*, $4.00 (17s.).

The best modern book on design and construction of walls, bins, etc.

The new edition is enlarged by 150 pages and is a thorough revision. It is up to date again.

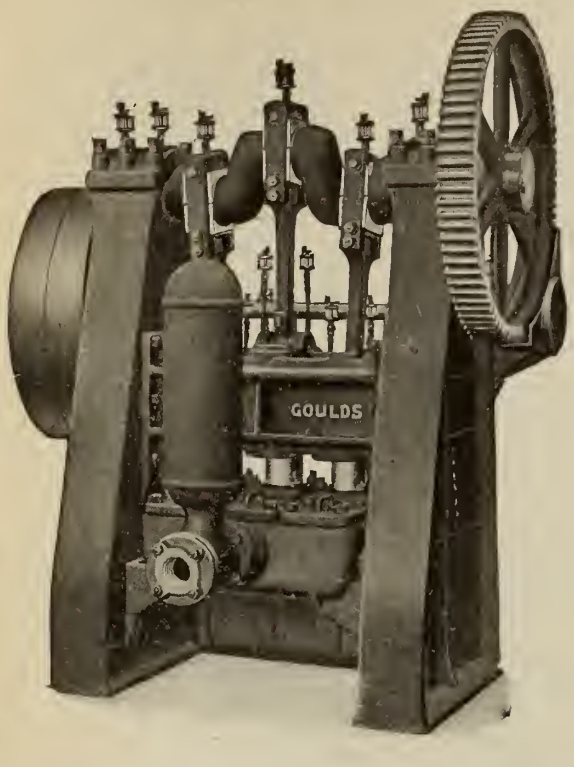
Metallurgy—*Vol. 1—Fundamentals*

By Herbert Lang, Author of "Matte Smelting."
255 *pages*, 6 *x* 9, *illustrated*, $3.00 (12/6).

A new work with a fresh viewpoint. Volume one is a unit in itself. It makes the systematic approach to the subject, direct and easy. It discusses fundamentals in a scientific, logical manner.

For Sale by

The Canadian Mining Journal, 44-46 Lombard Street, Toronto



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam Shovels**: **Specially Flexible** Ropes for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

OF THE HIGHEST QUALITY

made from **special grades** of Wire drawn to our specifications and **carefully tested** before being used. They are at work in all parts of Canada from Vancouver to Halifax and are **everywhere recognised as** the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:–

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. **New Brunswick: W. H. Thorne & Co., Ltd., St. John.**
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Scott, O. N.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & Deyell
Heys, Thos. & Son.
Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd
Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place
New York City

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984. P. O. BOX 763

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

O. N. SCOTT, B. Sc.
MINING ENGINEER
DOMINION BOND BUILDING
(*Cor. King and Yonge Sts.*) TORONTO
Tel. Main 1585 Cable Address "Onscott"

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

MAURICE W. SUMMERHAYES
Mining Engineer,
McENANEY MINES
Schumacher P.O., - Ont.

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

CANADIAN MINING INSTITUTE

Annual Meeting March 4th, 5th and 6th.

RITZ-CARLTON HOTEL,
Sherbrooke Street West, MONTREAL.

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

ANNUAL REPORTS
Mining Company Reports should be very carefully printed. We can give you satisfaction.
INDUSTRIAL & TECHNICAL PRESS, LIMITED
44-46 Lombard Street, Toronto

Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

Experienced Mining Cost Clerk, Bookkeeper and Office Manager, seeks situation. Speaks fluent Spanish in addition to English.
Apply Box H, Canadian Mining Journal.

The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....

Address .....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

1085. Descriptive Sketch of the Geology and Economic Minerals of Canada. Accompanied by a geological and mineral map of Canada, by G. A. Young and R. W. Brock.
Guide Books to excursions of the International Geological Congress.
1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1165. Memoir No. 18. Bathurst District, New Brunswick, by G. A. Young. Maps not yet published.

QUEBEC

1186. Memoir No. 35. Reconnaissance aloug the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1220. Memoir 29. Oil and gas prospects of the Northwest Provinces of Canada, by Wyatt Malcolm.

BRITISH COLUMBIA

1206. Memoir No. 26. Geology and Mineral Resources of the Tulameen District, B.C., by Charles Camsell.
1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1042. Mineral Map of Canada. Scale 100 miles to 1 inch.
1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1208. Map 53A. Southeast Nova Scotia. Scale 4 miles to 1 inch.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
1300. Map 100A. Bell River, Quebec. Geology.

ONTARIO

1177. Map 31A. Larder Lake, Nipissing District, Ontario. Geology.
1244. Map 64A. Advance geological copy of map of Gowganda Mining Division and vicinity.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.
1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.
1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.
1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1195. Map 45A. Tulameen, Yale District, British Columbia. Topography.
1196. Map 46A. Tulameen, Yale District, British Columbia. Geology.
1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.
1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.
1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.
1304. Map 106A. Groundhog coal field, British Columbia. Geology.
1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

YUKON and NORTH WEST TERRITORIES

1089. Map 9A. Explored routes on parts of the Albany, Severn and Winisk Rivers. Scale 8 miles to 1 inch.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

WATERWORKS PUMPS

High Duty Horizontal Compound and Vertical Triple Expansion

PUMPING ENGINES

Capacities from One-Half Million to Thirty Million Gallons per twenty-four hours

Specifications on Request

The John Inglis Co.,
LIMITED

Boilermakers and Engineers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office: 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE

WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of

Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

Back or Current Numbers

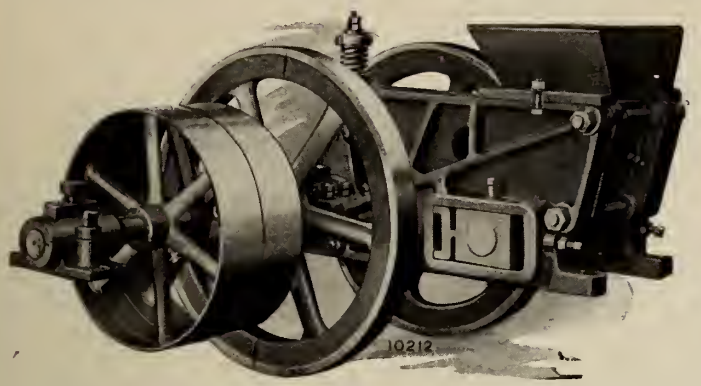
of any American or Foreign technical or trade Journal furnished on short notice at moderate rates; also newspapers and magazines. Government and State Reports of all kinds in stock. Clippings on special subjects furnished promptly. Magazines and papers of all kinds bought.

Special subscription price list on request.

A. W. Castellanos
263 Armstrong Avenue
Jersey City, N.J., U.S.A.

JAW CRUSHERS

BLAKE AND DODGE STANDARD AND SECTIONAL



With the assistance of some of our friends whose experience has been with the small plants in remote regions and far from the railroad, and by the use of cast steel instead of cast iron for many of its parts, we have developed a very satisfactory Sectional Dodge Crusher, shown above, with receiving opening 7x9 inches. All pieces come within a 170 pound limit with the exception of the swing jaw (280 pounds) and two frame sections 250 pounds each.

Send for Bulletin 1451.

Among the screens used in coarse crushing plants are the Dunlap patented screen shown above, in which an inclined screening surface travels counter-current to the passage of the ore and is cleaned at intervals, it being especially desirable for the ordinary ore coming from the mine in a wet, sticky condition, and the conical revolving screen shown below.

CANADIAN ALLIS-CHALMERS, LIMITED

HEAD OFFICE: TORONTO. DISTRICT SALES OFFICES: MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER, PRINCE RUPERT.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $10 an acre for SUPERIOR METALS when more than 20 miles distant from a railway and $20 an acre when less than 20 miles.

For INFERIOR METALS the prices are $2.00 and $4.00 an acre respectively.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co..... 22
Amatite Roofing 13
American Diamond Rock Drill Co. 16
Astley, J. W..... 23

B

Bartlett, C. O., & Snow Co..... 17
Bath, Henry & Son..... 28
Beatty, M. & Sons, Ltd..... 11
Belleville Assay Office 25
Bennet, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons..... 16
Blackwell, Geo. G., Sons & Co.... 28
British Columbia, Province of.... 18
Brown & Butters 23
Burchell, Geo. B. 23

C

Canadian Allis-Chalmers, Ltd. 29
Campbell & Deyell 25
Canadian Bag Co..... 13
Canadian Bank of Commerce..... 8
Canadian Cleveland Drill Co. 5
Canadian Copper Co..... 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Laboratories, Ltd..... 25
Canadian Northern Steamships..... 6
Canadian Ingersoll-Rand Co., Ltd. 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith..... 23
Castellanos, A. W. 28
Cohen, S. W..... 23
Colvocoresses, G. M..... 23
Consolidated Mining & Smelting Co. 28
Coniagas Reduction Co., Ltd..... 28
Curtis's & Harvey.....
.....Outside back cover

D

Dept. of Mines, Canada..... 26
Deloro Mining & Reduction Co.... 28
DePencier, H. P..... 23
Diamond Drill Contracting Co.... 16
Dominion Coal Co., Ltd..... 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co..... 16
Donald, Dr. J. T..... 25
H. A. Drury Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W..... 23

F

Ferrier, W. F..... 23
Fleck, Alex. 6
Flory, S., Mfg. Co..... 12
Forbes, D. L. H..... 23
Fowler, S. S..... 23
Fraser & Chalmers of Can., Ltd. ... 4
Federal Engineering Co., Ltd. ... 31

G

Graham, S. N..... 23
Gray, John. 25
Greening, B., Wire Co., Ltd..... 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John. 24
Hardman, J. E..... 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd..... 25
Heys, Thos. & Son..... 25
Hille, F. 24
Holman Drill Co..... 20

I

Inglis, John & Co., Ltd..... 27
Imperial Bank of Canada 2
Industrial & Technical Press 14
International Nickel Co. 8
International Engineering Works Ltd. 11

J

James Ore Concentrator Co.....
.....Outside back cover
Jeffrey Mfg. Co. 19
Johnson, W. S..... 24
Jones & Glassco..... 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co..... 25
Legg Brothers 35
Loring, F. C..... 24
Lymans, Limited 5
Lands of the Algoma Central and Hudson Bay Ry..... 3

M

Morton, B. K. & Co..... 18
McEvoy, James 24
Mussens, Limited. . . ..
.....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co..... 10
Nova Scotia, Province of..... 15
Northern Canada Supply Co., Ltd... 6
Northern Electric & Mfg. Co., Ltd.. 9

O

Orrenstein-Arthur Koppel Co..... 5
Orford Copper Co. 8
Ontario, Province of 30

P

Paterson Mfg. Co..... 13
Peacock Bros. 7
Pickings, H. B. 24
Pyke, Jas. W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd..... 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Scott, O. N. 24
Segsworth, W. E..... 24
Smart-Turner Machine Co..... 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co 25
Smith, Thos. & Wm., Ltd.....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Sullivan Machinery Co..... 2
Summerhayes, Maurice W..... 24
Swedish Steel & Importing Co., Ltd. 12
Standard Underground Cable Co. of Canada, Ltd. 15

T

Toronto University 2
Tyrrell, J. B..... 24

W

Willmott, A. B..... 24
Walker Bros. 7
Waterous Engine Works Co., Ltd... 9

A TEST OF FOUR HUNDRED YEARS

SUITS OF ARMOR, MADE BY THE INCAS, AND IMPREGNATED WITH BALATA GUM ARE UNIMPAIRED TO-DAY

LANCO BALATA BELTING

DOES NOT DEPRECIATE WITH AGE

Ideal For all Atmospheric Conditions Except Heat

Write for Catalogue

FEDERAL ENGINEERING CO., LIMITED

TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt.
Ledoux & Co., 99 John St., New York.
Thos. Heys & Son.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.

Bags—
Canadian Bag Co., Ltd.
Smart-Woods, Ltd.

Ball Mills—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Mussens, Limited.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried.A. G., Germany.
Mussens, Limited.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Limited.
Northern Canada Supply Co.
Jones & Glassco.
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineering Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd.
Thomas & William Smith.
Can. Ingersoll-Rand Co., Ltd.
Curtis & Harvey (Canada), Limited.
Mussens, Limited.
Northern Canada Supply Co.

Blowers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried.A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.

Boilers
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd.
The John Inglis Co., Ltd.

Buckets—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Limited.
Northern Canada Supply Co.

Buildings—Steel Frame
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd.

Cable — Aerial and Underground—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Limited
Mussens, Limited.

Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Limited.
Northern Canada Supply Co.

Cables—Wire—
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.

Carriers—
The Herbert Morris Crane & Hoist Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co

Case Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Cement Machinery—
Canadian Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.

Chains—
Jeffrey Mfg. Co.
Peacock Brothers.
Jones & Glassco.
Mussens, Limited.
Canadian Fairbanks-Morse Co,
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.

Chain, Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell.
Thos. Heys & Son.
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Limited.

Coal Handling Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd

Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Limited.
Peacock Brothers.

Compressors—Air—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd.
Laurie & Lamb.
Canadian Westinghouse.
Can. Ingersoll-Rand Co., Ltd,
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Limited.
Peacock Brothers.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Canadian Allis-Chalmers, Ltd.
Peacocks Brothers.
Mussens, Limited.
Northern Canada Supply Co.

Condensers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Brothers.
Laurie & Lamb.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Brothers.
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Waterous Engine Works.
Canadian Fairbanks-Morse. Co., Ltd.

Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
SmartTurner Machine Co.
Peacock Brothers.
Mussens, Limited.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany.

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Gantry—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Hand Power—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith.
B. Greening Wire Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Lymans, Limited.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Hadfields Steel Foundry Co.

Cyanide Plants—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Roessler & Hasslacher.
Mussens, Limited.
Thomas & William Smith.
Peacock Brothers.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Limited.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd.
Peacock Brothers.
M. Beatty & Sons.
Mussens, Limited.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Brothers.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Standard Diamond Drill Co.

Drills—Diamond.
American Diamond Rock Drills.
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Canadian Ingersoll-Rand Co.
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Siemens Co. of Can., Ltd.
Canadian Ingersoll-Rand Co.

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Limited.
Orenstein-Arthur Koppel Co.

Dynamite—
Curtis & Harvey (Canada), Limited.
Canadian Explosives.
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Limited.
Peacock Brothers.
Can. Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Elevators—
Canadian Allis-Chalmers, Ltd.
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany.
M. Beatty & Sons.
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Peacock Brothers.

Engineering Instruments—
C. L. Berger & Sons.
Peacock Brothers.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Brothers.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Mussens, Limited.
Alex. Fleck.
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Brothers.
M. Beatty & Sons.
Canadian Westinghouse.
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Peacock Brothers.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Brothers.
The John Englis Co., Ltd.
Can. Fairbanks-Morse Co.

Engines—Oil—
Peacock Brothers.
Can. Fairbanks-Morse Co.

Engines—Steam—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Smart-Turner Mahine Co.
Rohb Engineering Co.
S. Flory Mfg. Co.
Alex. Fleck.
Peacock Bros.
M. Beatty & Sons.
Laurie & Lamb.
Mussens, Limited.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Brothers.
Mussens, Limited.

Feeders—Ore—
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried, A. G., Germany.
Mussens, Limited.

Filters—
Krupp, Fried, A. G., Germany.

Friction Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co. Ltd.

Forgings—
M. Beatty & Sons.
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Brothers.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :		Halifax
QUEBEC :		Montreal
ONTARIO :	Toronto, Cobalt, South Porcupine, Port Arthur,	Kingston
MANITOBA :		Winnipeg
ALBERTA :		Edmonton
BRITISH COLUMBIA :	Vancouver, Victoria, Nelson,	Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krupp, Fried, A. G., Germany.
Lymans, Limited.
Mussens, Limited.

Fuse—
Peacock Brothers.
Curtis & Harvey, (Canada). Limited.
Canadian Westinghouse.
Canadian Explosives.
Mussens, Limited.
Northern Canada Supply Co.

Gears—
Canadian Westinghouse.
Krupp, Fried, A. G., Germany.
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada., Ltd.

Girders—Steel—
Dominion Bridge Co.

Gravity Lowering Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Hangers—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Heaters—Feed Water—
Mussens, Limited.
Laurie & Lamb.
Canadian Westinghouse.
Peacock Brothers.
Fraser & Chalmers, Ltd.

High Speed Steel Twist Drills—
Mussens, Limited.
Northern Canada Supply Co.

Hoists—Air, Electric and Steam—
Can. Ingersoll-Rand Co. Ltd
Peacock Brothers.
Krupp, Fried, A. G., Germany.
Mussens Limited.
Canadian Allis-Chalmers, Ltd.
S. Flory Mfg. Co.
Jones & Glassco.
Waterous Engine Works.
M. Beatty & Sons.
Can. Fairbanks-Morse Co.
Fraser & Chalmers Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd.
Mussens, Limited.
Peacock Brothers.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Limited.
Waterous Engine Works.

Hose—
Can. Genl Electric Co., Ltd.
H. W. Johns-Manville Co.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Can. Cleveland Drill Co.
Northern Canada Supply Co.

Jacks—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd.
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany.
Mussens, Limited.
Canadian Allis-Chalmers, Ltd.
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Limited.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives.
Peacock Brothers.
Ackroyd & Best.
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works.
Northern Canada Supply Co.
Jones & Glassco.

Locomotives—electric—
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Siemens Co. of Can., Ltd.

Locomotives—Steam—
Mussens, Limited.
Canadian Westinghouse.

Metal Merchants—
Henry Bath & Son.
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada.
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Limited.
Can. Fairbanks-Morse Co.
Jeffrey Mfg. Co.
Canadian Westinghouse.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Ore Sacks—
Can. Bag Co.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.

Ore Testing Works
Ledoux & Co.
Can. Laboratories.
Milton Hersey Co., Ltd.
Campbell & Deyell.

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining & Smelting Co. of Canada.
Krupp, Fried, A. G., Germany.
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Limited.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Peacock Brothers.

Pipes—
Consolidated M. & S. Co.
Peacock Brothers.
Laurie & Lamb.
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Westinghouse.
Northern Canada Supply Co.

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Brothers.
Jones & Glassco.

Producer—Gas—
Krupp, Fried. A.G., Germany.
Mussens, Limited.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Can. Fairbanks-Morse Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
Smart-Turner Machine Co.
Krupp, Fried. A.G., Germany.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Northern Canada Supply Co.
Peacock Brothers.
Laurie & Lamb.
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Canadian Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Alex. Fleck.
Mussens, Limited.
Smart-Turner Machine Co.
Peacock Brothers.
Thos. & Wm. Smith.
M. Beatty & Sons.
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried, A.G., Germany.
Mussens, Limited.
Jeffrey Mfg. Co.
Canadian Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumotic—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Smart-Turner Machine Co.
Canadian Ingersoll-Rand Co.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Limited.
Can. Ingersoll-Rand Co., Ltd.

Pumps—Steam—
Canadian Ingersoll-Rand Co., Ltd.
Mussens, Limited.
Thos. & Wm. Smith.
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
Alex. Fleck.
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried. A.G., Germany.
Mussens, Limited.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A.G., Germany.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany.

Rolls—Crushing—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Fraser & Chalmers, Ltd.
Canadian Allis-Chalmers, Ltd

Roofing—
Patterson Mfg. Co.
Dominion Bridge Co.
Mussens, Limited.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith.
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories.
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany.
Thos. Hays & Sons.

Screens—
Mussens, Limited.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Self Landing, Self Delivery Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Smart-Turner Machine Co.
Peacock Brothers.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany.

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Mussens, Limited.
M. Beatty & Sons.

Slime Tables—
Diester Concentrator Co.
James Ore Concentrator.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Smelting Machinery—
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany.
Mussens, Limited.
Can. Allis-Chalmers.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drill—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A. G., Germany.
Can. Ingersoll-Rand Co., Ltd.
Peacock Brothers.
Swedish Steel & Imp. Co, Ltd

Steel—Tool—
Mussens, Limited.
Thos. & Wm. Smith.
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany.
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co, Ltd

Surveying Instruments—
Peacock Brothers.
W. F. Stanley.
C. L. Berger.

Switchboards—
Canadian Westinghouse.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Tanks—Cyanide, Etc.—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Limited.
B. Greening Wire Co.
Can. Allis-Chalmers Ltd

Transformers—
Canadian Westinghouse.
Can. Fairbanks-Morse Co.
Peacock Brothers.
Siemens Co. of Can., Ltd.

Transits—
C. L. Berger & Sons.
W. F. Stanley.
Peacock Brothers.

Tractors—Oil—
Canadian Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Limited.
Krupp, Fried. A. G., Germany.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse.
Peacock Brothers.
Laurie & Lamb.
Can. Allis-Chalmers, Ltd.
Siemens Co. of Can., Ltd.
Krupp, Fried. A. G., Germany,
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany.

Winding Engines—
Waterous Engine Works.
Mussens, Limited.
Can. Allis-Chalmers, Ltd.
Peacock Brothers.
Can. Ingersoll-Rand Co., Ltd.
Fraser Chalmers, Ltd.
Siemens Co. of Can., Ltd.

Wire Cloth—
Can. Allis-Chalmers, Ltd.
Mussens, Limited.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Standard Underground Cable Co. of Canada, Ltd.

Wire—Magnet—
Standard Underground Cable Co. of Canada, Ltd.

Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

LEGG BROS
ENGRAVING CO.
DESIGNING ENGRAVING
5 JORDAN ST
TORONTO CANADA

For constant speed, continuous service in your mine use

Westinghouse Induction Motors

Their simplicity, efficiency, reliability and strong construction insure long service at the lowest cost.—The only wearing parts, the bearings, have a large surface, and are self-oiling.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

—— FOR REGULATIONS, MAPS, ETC., APPLY TO ——

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M. A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

—— Published by ——

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

—— which also publishes ——

CANADIAN MINING JOURNAL *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

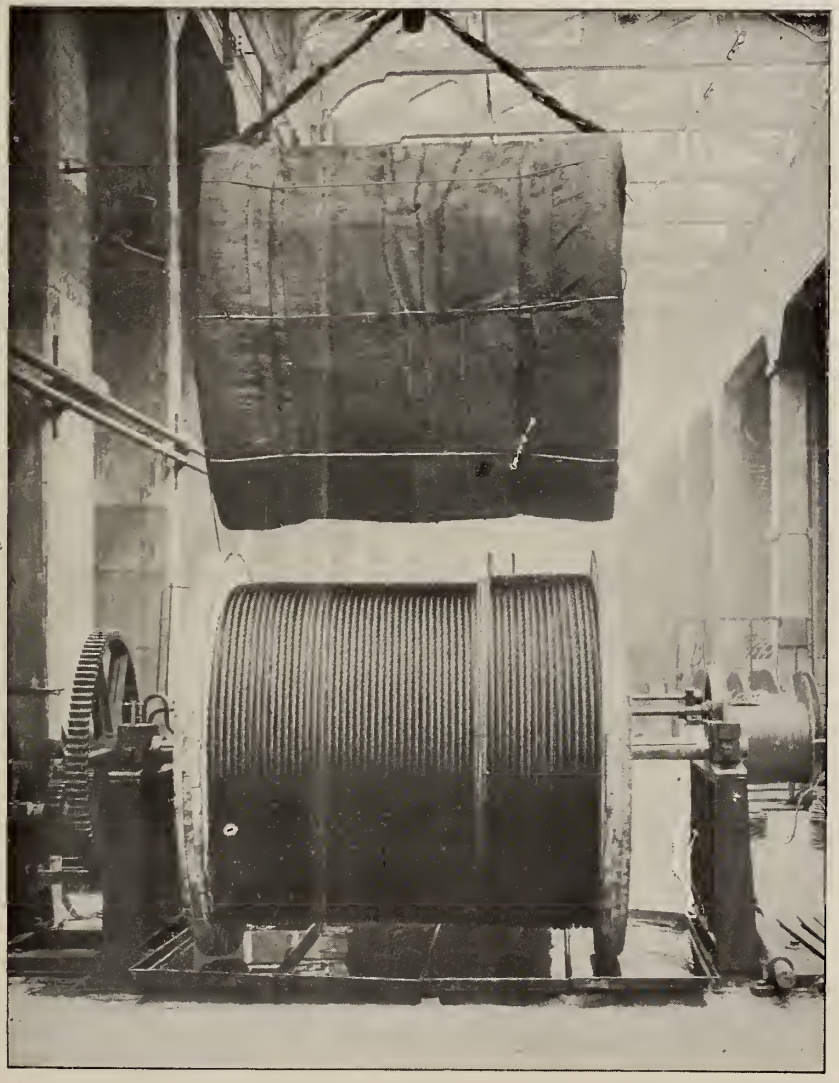
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For MINING:—
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.

The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

Canadian Mining Institute Annual Meeting

March 4th, 5th and 6th

MONTREAL

CURTISS & HARVEY (CANADA) LIMITED
DRAGON BRAND

We will be pleased to see you at

400 St. James Street

Lt. Col. James J. Riley, General Manager.

George Riley, Sales Representative.

Major W. B. King, Northern Representative.

MARCH 15, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 6

RIGHT UP-TO-DATE

HARDY (1914 TYPE) STOPER

AUTO ROTATER

AUTO REGULATOR

AUTO DUST ALLAYER

SPEEDY BORER

Send For Full Details

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER 101 Water St.
QUEBEC 31 St. Louis St.
ST. JOHN, N.B. 57 Symthe St.
HALIFAX 78 Granville St.

IMPORTANT ANNOUNCEMENT !

WE desire to announce to our good friends and the trade in general, that we are endeavoring to further our interests in the MINING, ROCK CRUSHING and CEMENT INDUSTRIES, and from now on will manufacture a full line of the following equipment :

MINING - ROCK CRUSHING - CEMENT MAKING

Stamp Mills
Feeders
Crushers
Tube Mills
Slag Pots
Forehearths
Charging Cars
Smelting Furnaces

Gyratory Crushers
Crushing Rolls
Jaw Crushers
Rotary Screens
Elevators
Conveyors
Bin Gates

Crushers
Feeders
Pulverators
Ball Mills
Tube Mills
Rotary Kilns
Rotary Coolers
Rotary Dryers

ALSO ROCK DRILLS AND AIR COMPRESSORS

We have secured the services of Experts in the above lines, and will undertake to DESIGN, BUILD and ERECT COMPLETE PLANTS. Purchase here and Save Part of Duty Taxed on Machinery Made in the States.

GYRATORY *and* JAW CRUSHERS

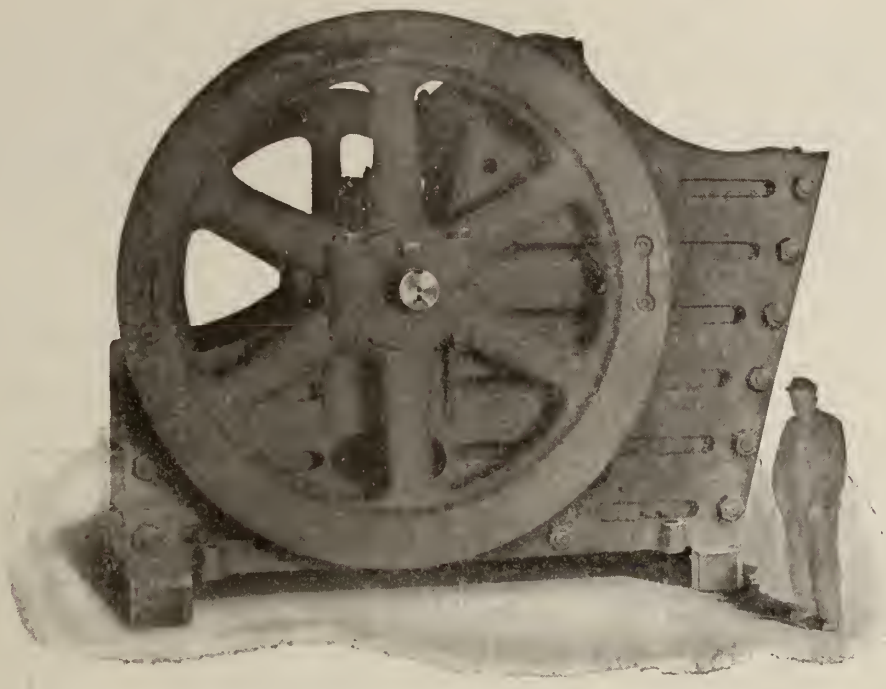
with **Water-Cooled Eccentric Bearings** *in each*

SEND FOR ADDITIONAL INFORMATION

The JENCKES MACHINE CO., Ltd.

Main Office and Works - - - SHERBROOKE, QUE.
Western Works - - - - - - - ST. CATHARINES, ONT.

DISTRICT OFFICES AT : MONTREAL, TORONTO, VANCOUVER, NELSON, COBALT, S. PORCUPINE



Kennedy Mammoth Jaw Crusher

RUNNING MATE TO THE GREAT 42 GYRATORY.

The above cut represents the Kennedy, balanced, steel frame, Jaw Crusher, made in sizes with openings from 7 x 10 to 96 x 60. By the substitution of steel frames for cast iron we make the machine 50% lighter and maintain 50% greater strength. With the balanced Jaw Crusher we cut down the power approximately 50%. Our Jaw Plates are corrugated on both sides and the angle of the stationary and movable Jaw is such that the Jaw plates are interchangeable from one Jaw holder to the other, reversible end for end and side for side, thus insuring at least 100% more wear out of the Jaw plates than can be procured from any other machine.

FJAB Rock Drill Steel, Hollow and Solid,

Stands for Quality—Uniformity—Reliability—Economy. Once Adopted Always Used.

WRITE FOR FURTHER PARTICULARS

Rock & Power Machinery

Limited

HEAD OFFICE: 12 King Street East, Toronto. Ont.

Exclusive Agents in Canada for the Kennedy Manufacturing and Engineering Co., Full Line of Stone Crushing Equipment.

Agents for the Bawden Steam Pumps.

BRANCH OFFICES:

VANCOUVER; CALGARY; WINNIPEG; SUDBURY;
COBALT; OTTAWA; MONTREAL; HALIFAX,
AND IN THE KING EDWARD HOTEL, TORONTO

Imperial Bank
of Canada
Established 1875

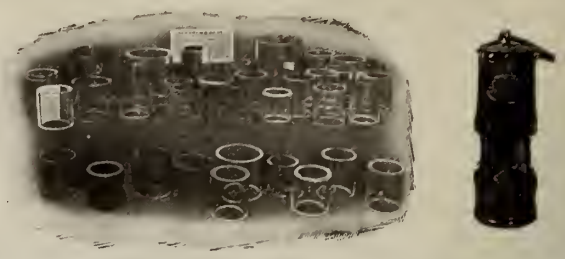
HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Subscribed	$7,000,000
Capital Paid Up	6,992,000
Reserve Fund	7,000,000

Branches in Northern Ontario at
Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of
Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.



SAFETY LAMPS AND GLASSES. Try our extra-tough glasses which have been made up specially to suit the conditions for use in MINERS' SAFETY LAMPS.

Ackroyd & Best, Ltd., The World's Safety Lamp Experts, MORLEY, - LEEDS, ENGLAND

For full particulars apply: **Ackroyd & Best, Ltd.,** No. 2 Arrott Power Buildings, Barker Place, Pittsburgh, Pa., U.S.A.
Telephone Nos.---P. & A. Tel. Main 2217. Bell, - - Grant 1619

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

For Calendar and other information apply to the Secretary,
A. T. LAING

FOR DRILLING UP-HOLES
—there's a
SULLIVAN STOPER

exactly suited to your needs. If your ground is soft or broken, choose "DF-21" Light-Hitting Stopers;

If your ground is hard and close, choose "DG-21" Heavy-Hitting Stopers;

Then there's the "DA-21" for average rock, and the "DC-21" with air jet, for flat holes. An atomizer may be attached to any of these, for laying dust.

Sullivan Stopers of all types are profit earners. Their great cutting speed, low air consumption and splendid stability, render them favorites in many of the world's mining districts.

Bulletin 666G

Sullivan Stopers in a Japanese Copper Mine

ROCK DRILLS AIR COMPRESSORS DIAMOND DRILLS

SULLIVAN MACHINERY COMPANY, 122 So. MICHIGAN AVENUE, CHICAGO, ILLINOIS.

About Air Compressor Ratings

Long established practice rates a compressor's capacity as the number of cubic feet of its piston displacement. And too many buyers forget that there is often a big difference between piston displacement and delivered air volume.

In Ingersoll-Rand Air Compressors, unusual care is taken to minimize this discrepancy between what the buyer buys and what he really secures.

Ingersoll-Rand Inlet Valves admit the maximum volume of free air per stroke—whether the speed be high or low. More than this, they keep the air in, by virtue of their tight seating and their closing at just the right time.

Ingersoll-Rand Discharge Valves deliver the maximum volume of compressed air from the cylinder—and keep it out.

Ingersoll-Rand workmanship on cylinder bores, piston rings, stuffing boxes and valves is such as to reduce leakage to the practical limit.

Ingersoll-Rand cooling systems are so thorough as to minimize the loss of capacity due to the heating of the free air.

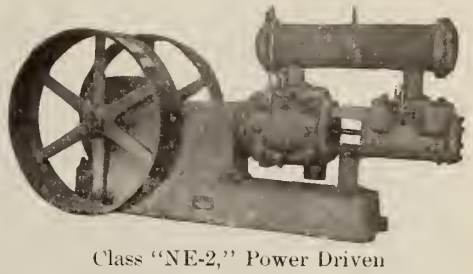
As a result of all this care in design and construction, the actual delivered volume of Ingersoll-Rand Compressors is very close to their actual piston displacement.

Canadian Ingersoll-Rand Co., Limited

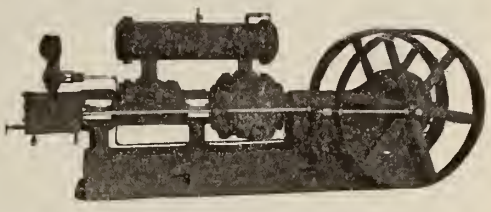
Commercial Union Building, Montreal, Canada

WORKS: SHERBROOKE, QUE.

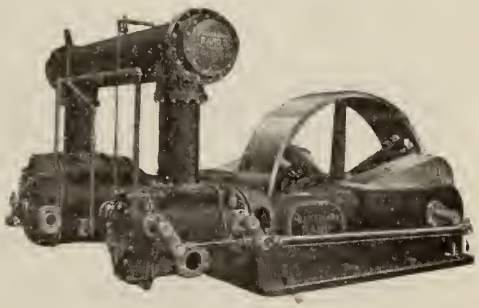
SYDNEY TORONTO COBALT SOUTH PORCUPINE
WINNIPEG LETHBRIDGE NELSON VANCOUVER



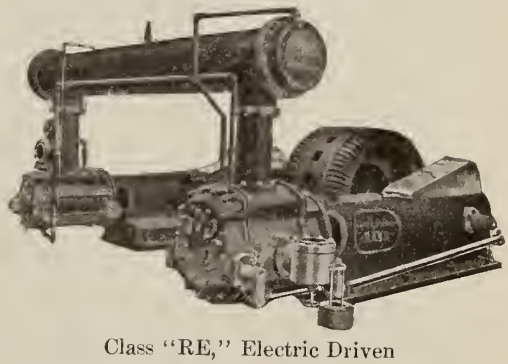
Class "NE-2," Power Driven



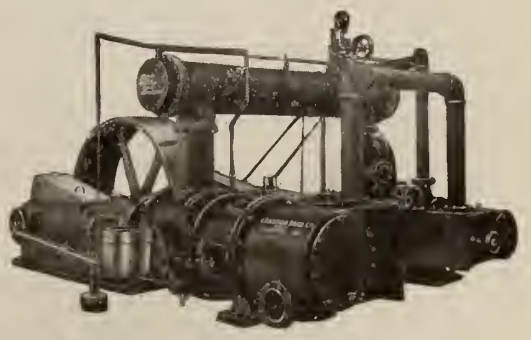
Class "NF-2," Steam Driven



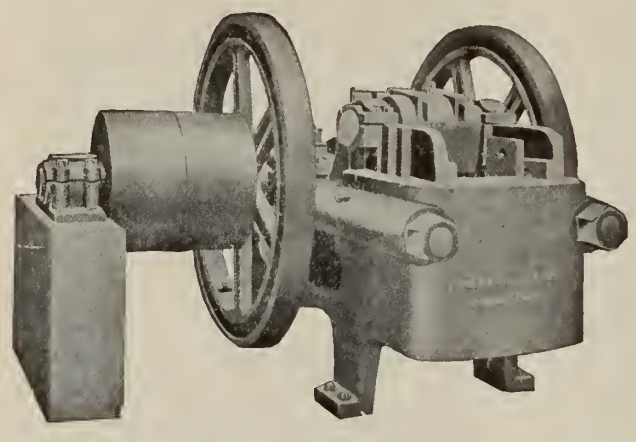
Class "RP," Power Driven



Class "RE," Electric Driven



Class "RS-3," Steam or Power Driven



BLAKE CRUSHERS, as designed and manufactured by Fraser & Chalmers Limited, are particularly adapted for crushing highly metalliferous ores.

Our Crushers are fitted with manganese steel jaw plates and side liners.

ALL SIZES CARRIED IN MONTREAL STOCK FOR IMMEDIATE SHIPMENT.

Write for Bulletin E.3

FRASER & CHALMERS OF CANADA

4 PHILLIPS PLACE LIMITED MONTREAL, P.Q.

ASSAYERS' AND CHEMISTS' SUPPLIES

Mercury, Cyanide, Caustic Soda, Sodium Carbonate, Sodium Bicarbonate, Bone Ash, Powdered and Glass Borax, Test Lead, C.P., Litharge C.P., Litharge Commercial, Zinc Sheet and Zinc Dust, Aluminum Dust, Baker and Adamson C.P. Chemicals.

Morgan Battersea Clay Goods, Furnaces, Crucibles, Muffles, Scorifiers, Ainsworth Balances, Jena Glassware and Laboratory equipment of all kinds. Engineers, Surveyors and Draughtsman's Tools, Tapes, Books, Inks, etc.

Shelf and Heavy Hardware of all kinds.

Wood Pulleys,
Steel Pulleys,
Iron Pulleys,
Shafting,
Hangers,
Pillow Blocks,
Collars, etc.
Goodyear Rubber Belting,
Leather Belting,
Stoves and Ranges.

Brass Valves,
Iron Body Valves,
All Iron Valves,
Pipe Fittings,
Black and Galvanized Pipe,
Ventilation Pipe,
Blowers and Fans,
Tools, all kinds,
Drill Steel,
Bar Iron.

Mild Steel,
Steel Plates,
Angles,
Rails,
Fish Plates,
Bolts and Spikes,
Candles,
Carbide Lamps,
Carbide,
Mazda Lamps,

Jute Ore Sacks.
Duck and Paper Concentrate Sacks,
Corrugated Iron,
Metal Siding and Roofing,
Roofing Felts,
Building Paper,
Nails, Glass, etc.
B & S Wall Board.
P. & B. Paints.

WAUGH STOPING DRILLS are leaders. Ask the man who uses them.

THE GEORGE TAYLOR HARDWARE CO. LIMITED

NEW LISKEARD (Head Office) COBALT COCHRANE

GOLD

Its Geological Occurrence and Geographical Distribution

By MALCOLM MACLAREN

This is an excellent treatise, carefully written by a well-known authority on gold deposits.

It is the most comprehensive work on the subject, and contains authentic descriptions of gold deposits in all parts of the world.

Accuracy and brevity are notable features.

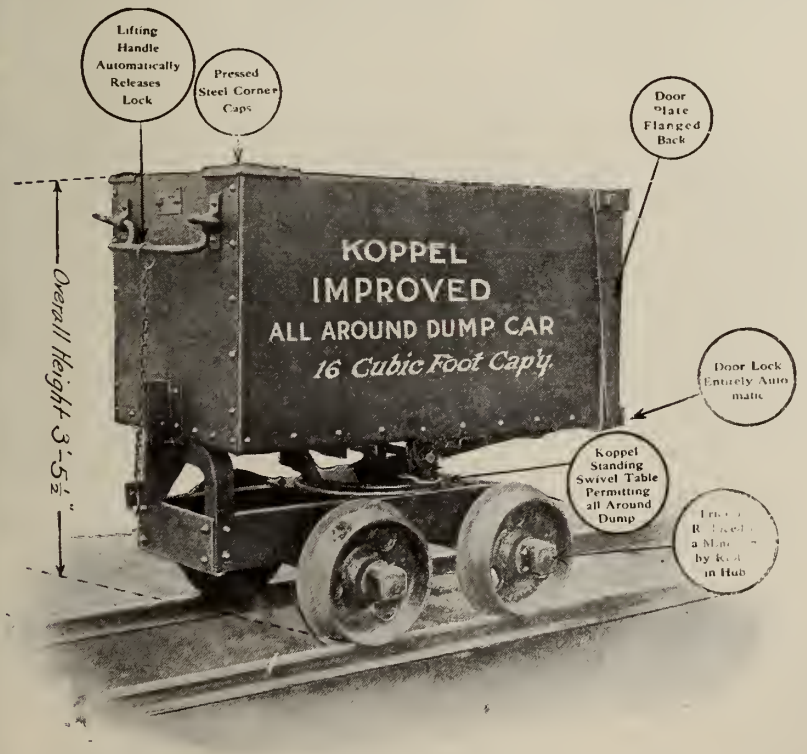
The volume is well printed and contains 278 illustrations.

The price is $7.50.

Book Department, Canadian Mining Journal

44-46 Lombard Street, Toronto

Koppel Improved Type of All Around Dump Car



This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N.B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

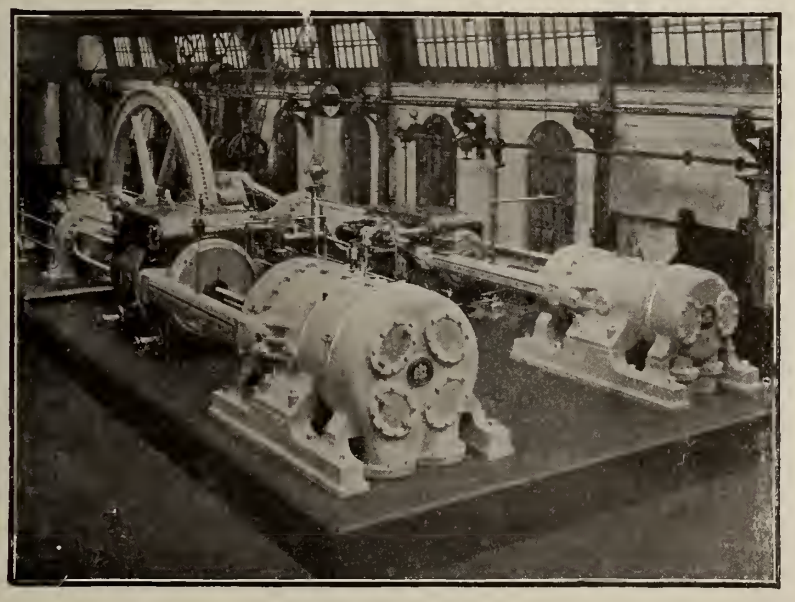
THE SUPREME METAL
FOR WEARING PARTS

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

The Canadian Bank of Commerce

PAID-UP CAPITAL, $15,000,000
RESERVE - - 13,500,000

DRAFTS ON FOREIGN COUNTRIES

Arrangements have recently been completed under which the branches of this Bank are able to issue Drafts on the principal points in the following countries.

Austria-Hungary	Fr'ch Cochin-China	Norway
Belgium	Germany	Persia
Brazil	Great Britain	Phillipine Islands
Bulgaria	Greece	Roumania
Ceylon	Holland	Russia
China	Iceland	Servia
Crete	India	Siam
Denmark	Ireland	South Africa
Egypt	Italy	Straits Settlements
Faroe Islands	Japan	Sweden
Finland	Java	Switzerland
Formosa	Manchuria	Turkey
France	Mexico	West Indies and elsewhere

No Delay in Issuing. Full Particulars on Application.

American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages,* 6*x*9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

"No more repair bills for that Roof"

Think of the money you could have saved if your buildings had been covered with a roofing that never had to be coated, gravelled or repaired! You'll never have to spend a cent for coating or repairs if you use

J-M ASBESTOS ROOFING

It is the cheapest-per-year roofing on the market.

J-M Asbestos Roofing is mineral throughout—layer upon layer of pure asbestos (rock) fibres everlastingly cemented together with Trinidad Lake Asphalt—literally *a sheet of pliable stone.* Contains no perishable substance. Has been in service on hundreds of buildings for over a quarter-century and is sound to-day.

Keeps buildings cool in summer, warm in winter, and affords perfect fire protection.

Anyone can apply it. Don't take a substitute. J-M Roofing Cleats, packed in each roll, make absolutely watertight laps and give the entire roof a handsome white appearance. Our nearest Branch will ship direct if your dealer can't supply you.

Write to-day for Sample and Catalog

THE CANADIAN H. W. JOHNS-MANVILLE CO., LIMITED

Manufacturers of Asbestos Packings; Pipe Coverings; High Temperature Cements. "ASBESTOS." Boiler Preservative; Conduit; Metallic Hose; Fuses; Boiler Plugs; Stack Lining; Tube Cleaners, etc.

TORONTO MONTREAL WINNIPEG VANCOUVER 1964

SARTORIUS

BALANCE

MODEL

"AMERICA"

WRITE FOR DESCRIPTIVE CIRCULAR

LYMANS, LIMITED

MONTREAL

Genuine Satisfaction

If you have anything to do with Rock Drills, you have, probably, been disgusted with them many times and wished you were running by hand. You are striving for fewer delays, lower mining costs, increased tonnage, and increased profits, and cannot afford to leave anything untried which would aid in the attainment of the above.

Can you afford therefore to pass by

THE

"CLEVELAND" STOPE DRILL

and not give it a trial when we can guarantee that it will relieve you of this part of your troubles.

There are so many reasons "why" that we haven't space enough here to enumerate them, but will you please

Write for Bulletin No. 30.

Cleveland Pneumatic Tool Co.

OF CANADA, LIMITED

Successors to

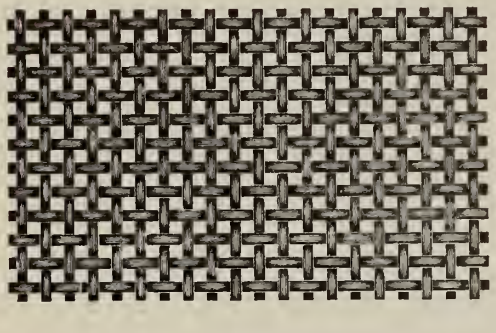
The Canadian Cleveland Drill Co.

Limited

80 Duchess Street, TORONTO

GREENING'S

WIRE CLOTH - WIRE SCREENING



ALL GRADES OF WIRE CLOTH
DOUBLE CRIMPED

Screening Accuracy guaranteed.

Made of Steel, Copper or Brass.

Galvanized and Tinned Cloth.

PERFORATED METALS WIRE ROPE

The B. GREENING WIRE CO., Ltd.

HAMILTON, ONT. MONTREAL, QUE.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 1 4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, NOVA SCOTIA

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

Won't this ROBB

MINE HOISTING ENGINE

just suit you ?

Two Robb-Armstrong side-crank engines, 22 inches diameter by 42 inches stroke. Engine bearings hard babbit.

Two Drums 8 feet in diameter, 58 inches wide. Bronze sleeves.

New, complete, with steam brake, steam-operated clutch, throttle valve, etc.

FULLY GUARANTEED.

For Photos, Drawings, etc., write to

International Engineering Works Limited
AMHERST, N.S.
Transportation Building. Montreal
Traders Bank Building, Toronto
39-49

"BEATTY"

Material Handling Plant

Hoisting Engines
Clamshell Buckets
Steel Derricks
Derrick Irons
Centrifugal Pumps
Dipper Dredges
Steel Scows, Etc.

Your requirements for anything in this line can be promptly filled by us, for we have a big stock of finished plant ready for immediate shipment, so are in fine shape to serve you.

Let us know your needs—we can interest you.

M. BEATTY & SONS, Limited
WELLAND, ONTARIO

AGENTS:
H. E. Plant, 1790 St. James St., Montreal.
H. W. Petrie, Ltd., Toronto
E. Leonard & Sons, St. John, N.B.
R. Hamilton & Co., Vancouver
A. R. Williams Machinery Co., Winnipeg

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records
Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

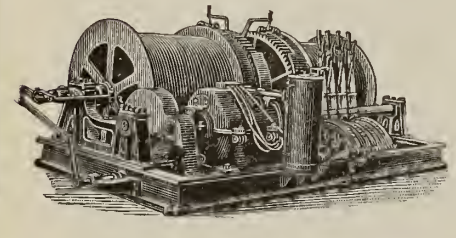
HEAD OFFICE AND FACTORY TORONTO
BRANCH FACTORIES WINNIPEG AND MONTREAL

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.



Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.

S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

Office and Works: BANGOR, Pa., U.S.A.

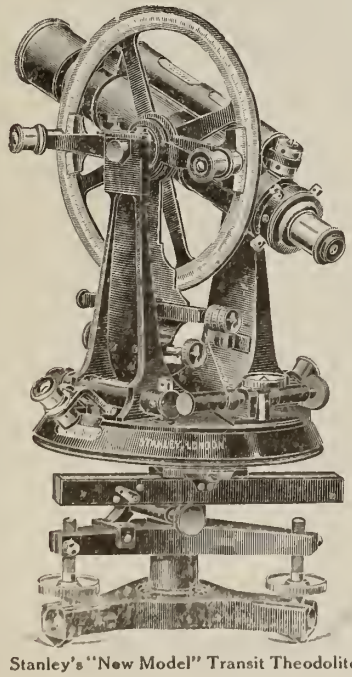
SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade **STANLEY** Mark



Stanley's "New Model" Transit Theodolite.

The largest manufacturers of

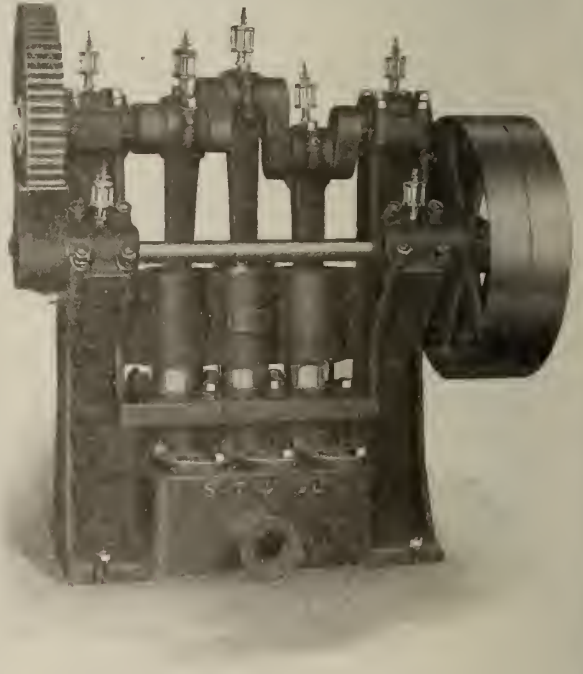
SURVEYING and DRAWING INSTRUMENTS in the world.

DRAWING OFFICE STATIONERY of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our "K 35" Catalogue (post and duty free) and compare our prices with those of other first-class makers.

W. F. Stanley & Co., Limited
Export Dept.: Great Turnstile, High Holborn, W.C.
Head Offices and Showrooms:
286, High Holborn, London, W.C., England

WE STAND BEHIND OUR PUMPS
Entire Satisfaction Guaranteed. Write for Our Catalogue.



The Smart Turner Machine Co.
LIMITED
Hamilton, Canada

BAGS!

Jute Cotton Duck

FOR

ASBESTOS COAL ORE

CONCENTRATES

FLOUR GRAIN FEED

PRINTING A SPECIALTY

The Canadian Bag Company Limited

Head Office: Montreal

TORONTO WINNIPEG

Amatite ROOFING

Figure It Out Yourself!

THE proposition is so simple that it hardly needs figuring. It is simply this: Most of the ready roofings on the market have a smooth surface which *requires painting every year or two.*

Amatite has a real mineral surface that *needs no painting.*

The cost is about the same.

If you buy a roofing that needs painting, you must figure on the expense of paint and the labor. If you neglect to paint it the roof soon falls apart.

Anyone who will spend a few moments investigating the proposition cannot help but decide on Amatite. Sample and booklets free on request.

THE PATERSON MFG. CO., Limited

Montreal, Toronto, Winnipeg, Vancouver, St. John, N.B., Halifax, N.S. Sydney, N.S.

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets.
Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

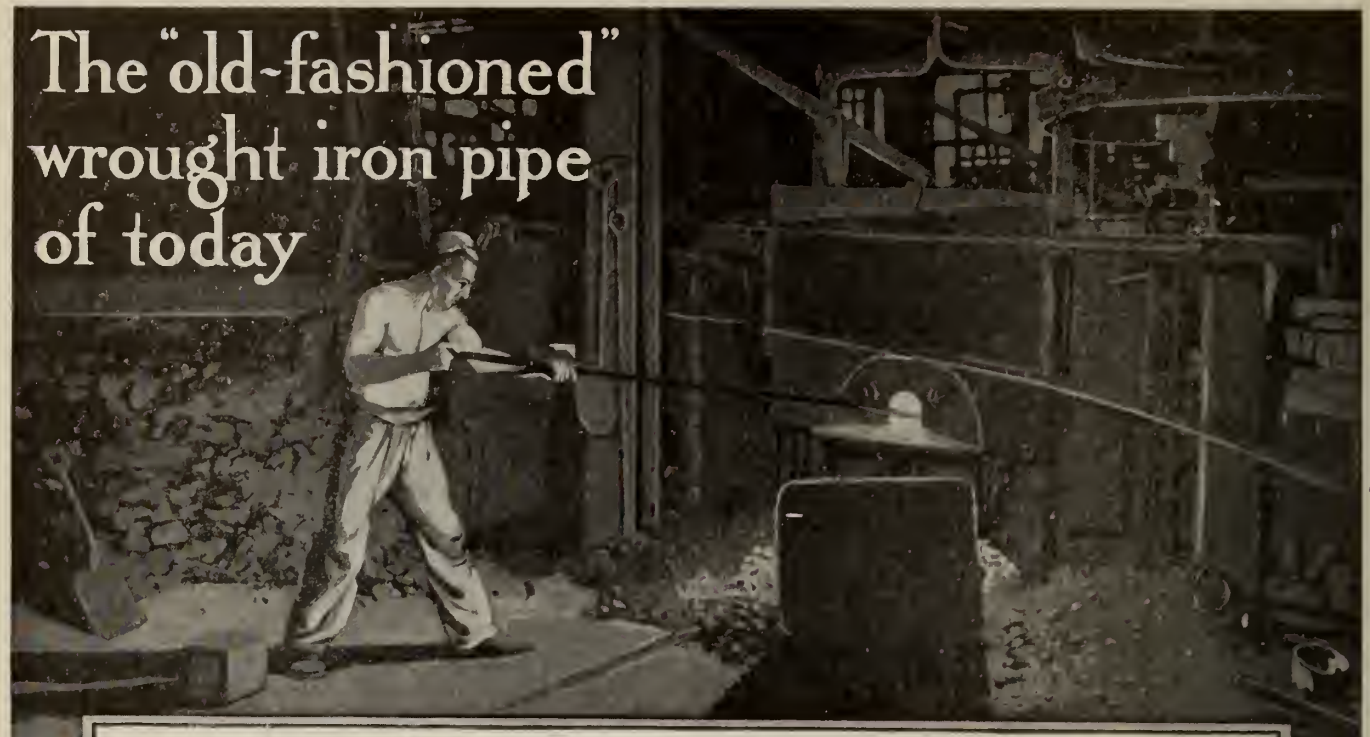
Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

The "old-fashioned" wrought iron pipe of today



BYERS GENUINE WROUGHT IRON FULL WEIGHT GUARANTEED PIPE

INVENTION has discovered no royal tonnage road to the production of genuine wrought iron pipe.

The straight and narrow path of hand puddling in small heats—in the "old-fashioned" way—is still the only way.

While the equipment and organization of the Byers plants are probably the newest and best in the industry, and embody the most modern principles of efficient operation, the methods and processes themselves stand unchanged from the practice of fifty years.

Simply because no other method is comparable to skillful hand puddling, at a comparatively low temperature, for converting the pig-iron.

Nor is it possible, by the mere mechanical rolling of the original steel ingot into the finished product, to obtain the uniform, fibrous, corrosion-resistant texture that results from the Byers hand-controlled squeezing and rolling, reheating and welding processes that convert the pig into muck bar, and the muck bar into skelp.

The difference between Byers Pipe and all other pipe—a difference that gives to Byers a reputation apart—begins at the Byers mines. This quality difference is carried through every subsequent operation—in Byers blast furnaces, puddling furnaces and rolling mills—each and every step in the process under Byers control and absolutely independent of every outside manufacturing influence.

Never has a ton of scrap entered a Byers gate, nor has there ever been a length of Byers Pipe marketed that was not full weight—guaranteed.

Such care in the selection of raw material, such control of every process of manufacture, and such high standards to which the finished product must attain, have created inevitably the remarkable durability and service satisfaction for which Byers Pipe is so widely known.

A knowledge of the Byers ideals and methods will inspire even greater appreciation of the Byers quality in the minds of pipe users. Write for a copy of the Byers book—"*The Control of Quality in Every Process*"—it tells how Byers genuine "old-fashioned" wrought iron pipe is made.

Look for the Byers Mark on every length and coupling

A·M·BYERS COMPANY
ESTABLISHED 1864
PITTSBURGH PA.

District Agents at

New York City	Cleveland	Toledo	Denver	San Francisco
Boston	Detroit	Cincinnati	Los Angeles	Portland, Ore.
Philadelphia	Chicago	Buffalo	Jacksonville	

Write for the name of the Byers Dealer in your district. He can supply you immediately.

MINE

RAILS

12 to 45 Pounds

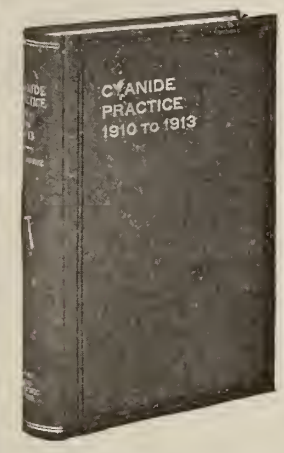
PROMPT SERVICE.

H. A. DRURY CO.

LIMITED

MONTREAL and TORONTO

CYANIDE PRACTICE
1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.

140 illustrations

Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings:

Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,

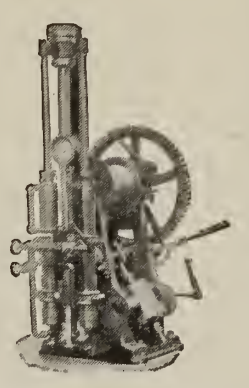
Commissioner of Public Works and Mines,

HALIFAX, N. S.

Diamond Drills

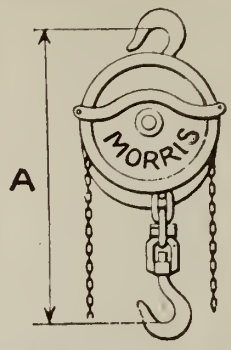
For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK



THIS IS ONE TYPE OUT OF 81 MORRIS CHAIN-BLOCKS

ONE SIZE OF 219 AT YOUR SERVICE.

THE HERBERT MORRIS CRANE & HOIST CO.
LIMITED,
EMPRESS WORKS, PETER STREET, TORONTO, ONT.
BRANCH OFFICE, CORISTINE BLDG., MONTREAL, QUE.

POSITION WANTED

As superintendent or foreman, by one who has had wide experience in Mechanical Construction, Draughting, Designing and Erecting of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc. References. Will accept small salary until value of services is demonstrated.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

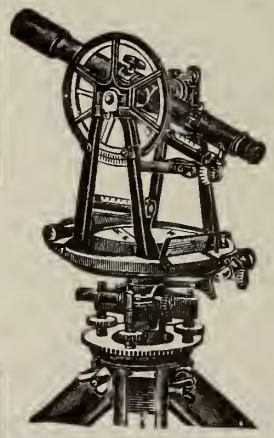
¶ Complete Bound Copies for 1913 Canadian Mining Journal, with Index, are now ready. Price $4.00 per volume. Canadian Mining Journal, 44-46 Lombard Street, Toronto.

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.



C. L. BERGER & SONS

37 Williams Street
BOSTON, - MASS.

SPECIALTIES:
Standard Instruments and Appliances for
Mining, Subway, Sewer and Tunnel, and all kinds of Underground work.

SEND FOR CATALOGUE

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

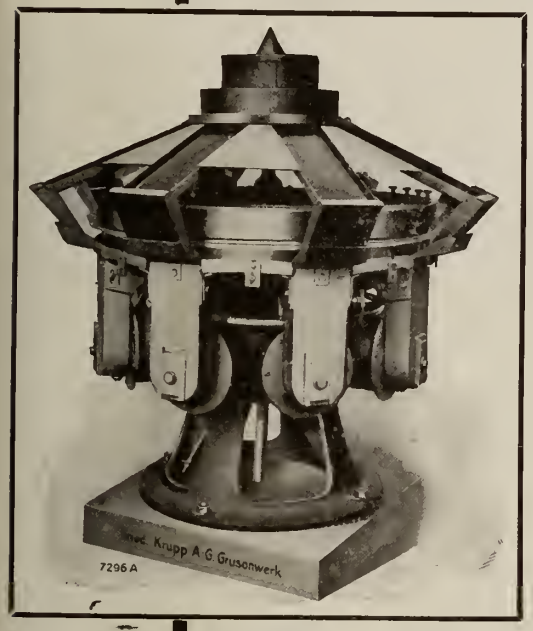
DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

"ULLRICH"
PATENT ELECTRO MAGNETIC WET & DRY SEPARATORS



treat all Kinds of strongly and weakly magnetic ores in one operation.

Ullrich's Patent Electro Magnetic Separators

have solved the problem of treating weakly magnetic ore under wet conditions; are the only machines with adjustable magnetic field zones, thus being applicable to difficult complex ores; treat coarse ore as well as slimes; have been introduced in many mines with highly satisfactory results.

The more difficult the ore, the more conspicuous the merits of the Ullrich Separator in capacity, simplicity and actual results.

Large Experimental Works for Concentration—and Magnetic Separation Tests

FRIED. KRUPP A.-G GRUSONWERK, MADGEBURG (GERMANY)

Canadian Representatives: JAS. W. PYKE & CO., LIMITED, 232 ST. JAMES STREET, MONTREAL

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM
(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

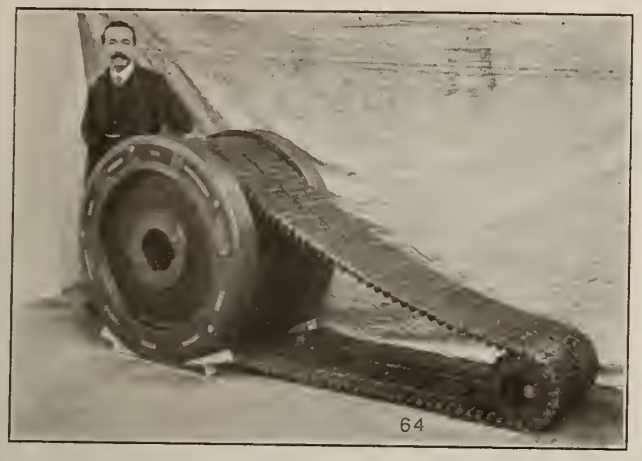
Manufactured by

B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.



200 H.P. Renold Chain Drive from Motor to No. 9 Roots Blower. Centres 6 feet.

The above cut illustrates one of four similar chain drives which replaced leather belts. Driven wheels are fitted with springs to absorb fluctuation of load.

Jones & Glassco (Regd) Engineers

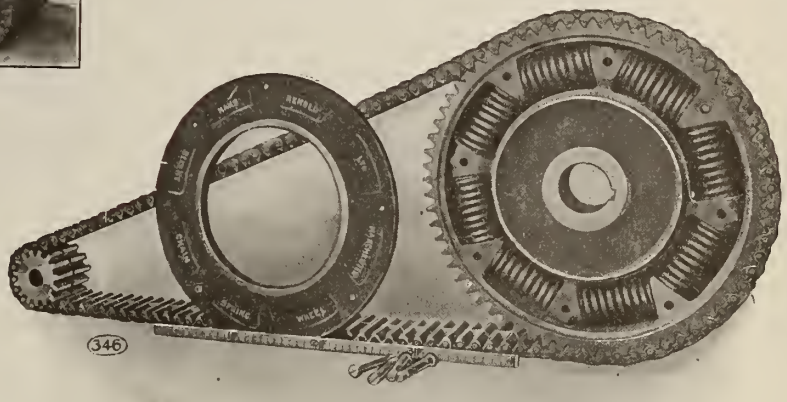
Sole Canadian Agents

49 Place D'Youville - - Montreal

Branch Office - Toronto

Renold Patent Silent Chains Driving Blowers

Effect Great Saving of Power and valuable space in a Prominent Canadian Plant.



Spring wheel, on lighter drive, with plate off, showing construction.

All Ready!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

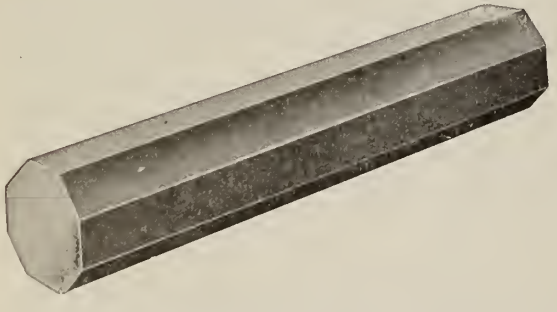
"CRESCENT" ROCK DRILL STEEL

Manufactured by
Walter Spencer Co., Limited,
Sheffield, England

Is particularly suitable for :

MINES AND CONTRACTORS who are unable to secure very expert blacksmiths, because it is easy to work.

Suitable for use where Machine Drill Sharpeners are used, as it can be hardened from the forging heat used in all makes of these machines. Used for welding to a cheap shank steel, as it is easily welded.



We stock CRESCENT ROCK DRILL STEEL in Octagon, Cruciform, Hollow Octagon, Hollow Hexagon, Canted Corners, etc.

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, March 15, 1914. No. 6

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

Editorial—	Page
The Iron Industry	181
Economic Minerals and Mining Industries of Canada	182
Mineral Production of Canada in the year 1913	182
Concentration and Cyanidation of Cobalt Silver Ores	182
First Aid Trophy	183
Canadian Mining Institute, Annual Meeting, 1914	184
Canadian Mining Institute, Western Branch	187
Canadian Mining Institute, Rocky Mountains Branch	188
Mineral Production of Canada in the Year 1913, by J. McLeish	189
Mineral Production of Ontario in the Year 1913, by T. W. Gibson	196
Kirkland Lake Flotations, by T. A. Richard	199
Gas and Oil Fields of New Brunswick, by Mathew Lodge	200
Manganese-Steel Rails, by Sir Robert Hadfield	204
The Mill and Metallurgical Practice of the Nipissing Mining Company, Cobalt, by James Johnston	205
Personal and General	211
Special Correspondence	212
Markets	216

THE IRON INDUSTRY

While great progress is being made in mining many metals in Canada the iron industry lags behind. The reason is undoubtedly that most of the iron deposits thus far discovered are not of a character to permit of profitable mining.

Iron smelters find it economical to import iron ores from other countries rather than to use Canadian ores. They would rather use Canadian ores if a good supply were available. Unfortunately the known deposits of good ore in Canada are few. It is very well known that there are many occurrences of iron ore in Canada, and that some of the deposits are large. The large deposits are, however, not of high grade and cannot be mined and smelted in competition with ores from outside. There are in Canada many extensive areas of "iron formations." It is not unlikely that good ore bodies occur in parts of these iron formations. The locating of them has, however, not yet been successful.

According to Mr. McLeish, of the Department of Mines, the iron ore shipments from Canadian mines in 1913 amounted to 307,634 tons, valued at $629,843. This is a very small amount as compared with the iron used in Canada. Imports of iron ore during the year amounted to 1,942,325 tons, valued at $3,877,824. Imports of pig iron amounted to 253,843 tons, valued at $3,234,877. There was also imported 926 tons of charcoal pig iron, valued at $12,528; and 30,355 tons ferro-manganese, ferro-silicon, etc., valued at $940,443.

The situation is not a new one. It has long been recognized as a painfully distressing one. An effort is now being made to relieve it by obtaining Government assistance in carrying on the industry. At Ottawa last week a proposal was made that a bounty should be given to the producers of iron ore. The amount asked for is about 50 cents per ton of ore produced and smelted in Canada.

That such a bounty would give a great impetus to the iron mining industry is beyond doubt. Many deposits now idle could be profitably worked. A large number of men would be given employment at mines, railways and smelters. The development of the present known deposits would doubtless lead to the discovery of others. Exploration for iron ores would be carried on with great enthusiasm and possibly result in the discovery of much better ore bodies. The bounty would not only aid those who are ready to mine known ore bodies, but would result in a very thorough search for iron ore throughout the country.

ECONOMIC MINERALS AND MINING INDUSTRIES IN CANADA

One of the most useful publications issued by the Mines Branch is the bulletin bearing the above title. It was compiled under the direction of Mr. J. McLeish, Chief of the Division of Mineral Resources and Statistics, who has had the co-operation of several officers of the Mines Branch staff; more particularly Messrs. C. T. Cartwright, L. H. Cole, H. Frechette, H. S. deSchmid, and A. W. G. Wilson; and the objective has been to present in a popular form a brief sketch of the more important economic minerals, and of the mining and metallurgical industries of Canada.

We have found much valuable information in this bulletin and have in recent issues published several short extracts concerning many minerals mined in Canada. We desire to give credit to the staff of the Mines Branch for these concise statements and to recommend our readers to apply to the Director of the Mines Branch for a copy of the bulletin.

MINERAL PRODUCTION OF CANADA IN THE YEAR 1913

In this issue we publish extracts from the preliminary reports for 1913 of the Department of Mines, Canada and the Bureau of Mines, Ontario. In our January 15 issue we published a report by Mr. E. Jacobs on mining in British Columbia during 1913, and a report by Mr. Theo. Denis on mining in Quebec. These reports all show that mining in Canada is a very important industry and that the industry is growing. The preliminary reports of Mr. J. McLeish for the Department of Mines, Canada, Mr. T. W. Gibson for the Bureau of Mines, Ontario, Mr. Theo. C. Denis for the Department of Mines, Quebec, were read at the recent meeting of the Canadian Mining Institute. The preliminary report of Mr. W. F. Robertson, for the Department of Mines of British Columbia was published several weeks ago. Copies can be obtained on application to the several departments.

CONCENTRATION AND CYANIDATION OF COBALT SILVER ORES

At the recent meeting of the Canadian Mining Institute two papers presented by Mr. James Johnston, of the Nipissing Mining Company, and Mr. Fraser Reid, of the Coniagas Company, showed that there is considerable room for discussion as to the best method of recovering the silver from low grade Cobalt silver ores. Mr. Johnston showed that excellent results are being obtained by cyanidation at the Nipissing plant. Mr. Reid showed that equally good results are being obtained by straight concentration at the Coniagas plant.

Mr. Johnston's paper has been published in bulletins of the Canadian Mining Institute and the American Institute of Mining Engineers. The description of the Nipissing cyanide plant was published in our February 1st issue, and part of this paper is published in this issue. The paper is an excellent description of the plant and methods. The basis for comparison of concentration and cyanide methods is, however, not clear. Mr. Johnston presents figures comparing a concentration mill giving an 80 per cent. extraction and costing $160,000 with a cyanide plant giving a 90 per cent. extraction and costing $250,000. He concludes that on ore assaying 30.99 oz. per ton the cyanide plant yields 28.88 oz. silver at a profit of $12.09 and the concentration plant 25.67 oz. at a profit of $10.50 per ton.

These estimates, so far as the cyanide plant is concerned, have been found well within the mark, the results obtained being a 92 to 93 per cent. extraction on a 26 oz. ore at a cost of less than $3.00 per ton. a plant costing $254,839.52, treating 244 tons per day.

On the other hand, however, there has been no similar check on the estimates regarding the concentration plant. Mr. Reid's paper will show that actual results obtained are better than the estimate. The operation of the Coniagas, Northern Customs and other mills using straight concentration methods has been brought to a high degree of perfection.

Early attempts to use cyanide methods were made by the Buffalo, O'Brien and Nova Scotia mining companies. These were regarded as only fairly successful. At the Buffalo only slimes were treated. At the Nova Scotia a combined amalgamation and cyanidation method was used.

It was at the O'Brien plant that aluminum was first used at Cobalt for precipitating silver. In 1906 S. F. Kirkpatrick, Professor of Metallurgy, School of Mining, Kingston, undertook some experiments, with the assistance of the Ontario Bureau of Mines, on the ores of the Cobalt district in order to develop a commercial process of treating them and saving the by-products. It was found that the ores were fairly amenable to cyanidation even when they contained 2,000 to 4,000 oz. silver per ton; but the cyanide consumption was heavy, and zinc was not an ideal precipitant, tending to foul the solution and give a bullion below market requirements. Mr. Kirkpatrick found that aluminum could be used satisfactorily, the difficulties experienced by earlier experimenters being overcome by using the metal in the form of a dust. The process was introduced by the Deloro Mining & Reduction Co., in 1908, and has been in use ever since.

In the Nipissing plant, described by Mr. Johnston, this feature of the O'Brien plant has been adopted. A distinctly new feature is the desulphurizing process devised by Mr. J. S. Denny. These two features, the aluminum dust precipitation and the desulphurizing by aluminum, are important factors in the cyanide process at Cobalt.

FIRST AID TROPHY

Those who are interested in First Aid work will be pleased to learn that the Honorable Louis Coderre, Minister of Mines, has presented to the St. John's Ambulance Association a trophy for annual competition among the mine workers of Canada.

Some time ago the Honorable Wallace Nesbitt gave a trophy for competition amongst railway employes; one for general competition in Canada and one for the cadets in each Province. These trophies have been the means of encouraging First Aid work. The trophy given by Mr. Coderre is for mining men only, and will be the means of stimulating First Aid work in connection with mines.

As was pointed out by Mr. W. J. Dick at the recent meeting of the Canadian Mining Institute, in Montreal, it is more important for miners to take a course in First Aid than for employes in other industrial work. In case of an accident on the surface it is generally only a matter of a few moments before a surgeon and ambulance are in attendance; but in case of accidents which happen underground it may be anywhere from half an hour to four or five hours before the assistance of a surgeon can be obtained or the man brought out of the mine. At some of our coal mines in the West it would take two or two and a half hours' fast walking to go from the face of the workings to the foot of the shaft. First Aid to be of any importance should be rendered immediately, and the natural one to administer First Aid is the person with whom the injured one is at work at the time of the accident.

Canadian mining men are learning that Mr. Coderre is taking a very sincere interest in the work of the Department of Mines. Those who traveled with him on the Western excursions of the Geological Congress are well aware of this. The evidence of interest in First Aid work, which the donation of this trophy shows, will be well received. Mr. Coderre deserves the hearty thanks of those who are trying to improve the conditions under which miners work.

GRANBY.

Vancouver, March 9.

It is expected that the new 2,000 ton smelter of the Granby Mining Co., at Granby Bay, will be blown in shortly. This smelter was to have commenced operations last week, but the dam broke, necessitating some repairs. The blowing in of this smelter will mean greater activity among the copper districts in the north. The Granby Co. alone has 2,000,000 tons of low grade ore already blocked out on its Hidden Creek property.

COPPER REPORT.

New York, March 9.

The statement of the Copper Producers' Association for February shows a decrease in stock on hand of 8,924,833 lb., compared with the previous month.

YUKON GOLD.

The Yukon Gold Company produced $4,789,402 gross gold in 1913 and the net profits were $1,453,536. The output and dividends compare as follows for the past five years:

	Production.	Dividends.
1909	$1,747,599	$700,000
1910	2,847,098	1,400,000
1911	3,106,227	1,312,500
1912	4,975,069	1,050,000
1913	4,789,402	1,050,000

TOUGH-OAKES.

London, March 11.

The Tough-Oakes Gold Mines, Ltd., offers 100,000 shares at par. The Financial News, in referring to this issue, says insufficient work has been done on the property to justify the capitalization of £500,000, and calls the shares a pure speculation. The Financial Times says they are very much of a gamble.

TIMISKAMING.

Toronto, March 11.

Counting of the votes in the Timiskaming shareholders' election was concluded last night, the final report being more favorable to the Wills ticket than was expected earlier in the day, the majority for the ticket being in the neighborhood of 700,000 shares. About 18,000,000 shares voted, a bigger response to the ten day campaign than resulted in the campaign two years ago, which ran for sixty days.

ASBESTOS CORPORATION OF CANADA.

The annual statement of the Asbestos Corporation of Canada, Limited, made public this week was rather disappointing. On the large capitalization of $4,000,000 preferred stock and $3,000,000 common, surplus earning for the year amounted to only $54,765, or equivalent to about 1.3 per cent. on the preferred shares.

Progress has been made in the past few years. Against a loss on operation of $64,614 in 1911, when the company was carrying a burden of nearly $400,000 in interest charges—that is the last year of the company before reorganization—the 1913 statement shows a profit from operation of $270,932, an amount sufficient to meet bond interest, to allow $67,416 for renewals and betterments, and to leave $54,765 to be carried forward to surplus account.

The reports of the president, Mr. W. G. Ross, and the general manager, Mr. J. D. Sharpe, both speak hopefully of the outlook. Mr. Ross states that "the tonnage of asbestos produced showed an increase over the preceding twelve months of 5,400 tons. The demand for asbestos has been exceptionally good and prices have improved. The unfilled orders on hand amount to $1,278,386." Mr. Sharpe supplements this by stating that "the contracts on hand for delivery during 1914 are sufficient to keep the properties in full operation during the year."

The new company continues to keep itself in a strong position. The balance sheet shows current assets of $1,075,682 against current liabilities of only $93,655, an increase of $50,000 in the former item and a decrease of about $8,000 in the latter. In current assets are included the large sum of $524,390 in cash. —Journal of Commerce.

CANADIAN MINING INSTITUTE ANNUAL MEETING, 1914

The sixteenth annual general meeting of the Canadian Mining Institute was held in Montreal at the Ritz-Carlton hotel on Wednesday, Thursday and Friday, March 4, 5 and 6, 1914. The attendance was smaller than in some former years; but the meeting was as usual a distinctly successful one.

The members were surprised to learn a few weeks before the meeting that a change had been made in location of headquarters. In a bulletin published a few days before the meeting, however, it was explained that such a move was necessary in the interests of the Institute. Many of those who attended the meeting expressed themselves as very well satisfied with the change. The room in which the meetings were held is undoubtedly the best that has yet been available for the purpose. It is large and beautifully decorated. Members were pleased to find that they could smoke during the sessions to their hearts' content without losing sight of one another. The rooms which were assigned to members are also very attractive. The absence of a large rotunda caused some unfavorable comment.

Business Meeting.

On Wednesday morning a business meeting was held. The presidential address was delivered by Dr. Barlow. Reports of officers were presented and the officers for the ensuing year were elected.

Statistical reports issued by the Dominion Mines Branch, the Ontario Bureau of Mines and the Quebec Mines Branch were presented by J. McLeish, chief of the Division of Mineral Resources and Statistics, Mines Branch; T. W. Gibson, Deputy Minister of Mines, Ontario, and by J. A. Bancroft, on behalf of Theo. Denis, Superintendent of Mines, Quebec. These reports are published in this issue of the Journal.

Dr. Barlow, in his presidential address, referred to the progress of the Institute, pointing out that at the end of the year the membership was 1,029, there being 113 new members. There were eight branches of the Institute, and during his regime two new branches had been formed, the Rocky Mountains and the Ottawa branches, the former being now the biggest with the exception of the Western branch. He gave a mede of praise to the secretary, Dr. Bancroft, J. E. Hardman and J. M. Gordon, for the excellence of the publication of the proceedings, and then referred to the fact that on the recommendation from the Institute it was expected that the Federal Mines Act and Explosives' Act would be introduced and passed by the Dominion House this session.

Touching on the question of the mineral resources of Canada, the president said that legislators were fond of dealing in generalities as to the vast resources of Canada. No nation could be truly great unless it had an abundant supply of minerals, coal and iron. Canada had plenty of coal, but her iron resources gave considerable anxiety. There had been quite a campaign to ask the Government to take some action towards putting a bounty on iron ore produced in Canada so as to stimulate the industry, and, at the same time, considerable exploration should be conducted in the great hinterland which was underlaid by Archean rocks, which gave promise of holding large deposits of iron. Resolutions had been submitted to Boards of Trade, and other public bodies, in which the Government were urged to take such measures and render such assistance to the obtaining and treatment of Canadian iron ore as would keep this industry in the Dominion to be developed for the benefit of Canadian people. He emphasized that it would be national suicide to adopt any such measure as an import duty on United States ore, considering that a bounty on Canadian ore would be the best method of increasing the output.

There was some discussion on the advisability of memorializing the Dominion Government to make an enquiry into the condition of the iron industry with a view to doing something to encourage it. At a later meeting Mr. Eugene Coste presented a resolution providing for the naming of a committee of Institute members to draft a memorial to the Dominion Government. This resolution was carried.

Two other resolutions were also proposed and carried. The first conveyed sympathy and condolences to the family of the late Hon. C. R. Devlin, Minister of Colonization, Mines and Fisheries, who had always been a staunch friend of the Institute. The second conveyed the thanks of the Institute to Hon. Louis Coderre for his action in offering a trophy for competition among first-aid teams in connection with the mining industries of the country.

This resolution, proposed by Mr. W. J. Dick, was worded as follows: "The Canadian Mining Institute, having learned that the Honorable Louis Coderre, Minister of Mines, has graciously donated a trophy to the St. John Ambulance Association for annual competition among all mine employees in Canada proficient in first-aid to the injured.

"Therefore, be it resolved that this Institute express its sincere appreciation of this generous gift, believing that it will not only stimulate the efforts put forth to instruct mine officials and miners generally in first-aid work, but at the same time will do much towards lessening suffering and will minimize the loss of efficiency due to mine accidents in Canada."

There was a discussion of proposed amendments to the by-laws, calling for the appointment of a nominating committee. Most of those who spoke showed themselves opposed to any such change. The proposals were not brought formally before the meeting, as Mr. J. M. Gordon, who advocated the changes, was unable to attend.

Technical Sessions.

The first technical session was held on Wednesday afternoon, Mr. A. A. Cole being in the chair. The papers presented were: "The Sampling of Cobalt Ores," by C. St. G. Campbell, Cobalt, Ont.; "Milling Practice at Cobalt," by Fraser D. Reid, superintendent of the Coniagas mill, Cobalt, and "Pyritic Smelting," by Geo. A. Guess, Professor of Metallurgy, Toronto University.

Sampling Cobalt Silver Ore.

Mr. Campbell gave a detailed description of the peculiarities of the Cobalt silver ores in so far as they are important in sampling. He showed that the rich ores are very difficult to sample accurately; but that successful methods have been devised at the sampling plant at Cobalt. He described the method of sampling and presented figures to show the accuracy of the method in use. The Cobalt district is fortunate in having in Cobalt a reliable sampling plant, and the members were pleased to hear the description of it by one of those who has given so much time and study to the perfecting of a reliable method.

Cobalt Milling Methods.

Mr. Fraser Reid, in presenting his paper on milling methods at Cobalt showed that the straight concentration methods have been very successful, and that stamps have been more satisfactory than other crushing devices used. He remarked that the use of cyanide was desirable under certain conditions; but that in some cases a very good recovery is being made without cyaniding, and that the additional cost of cyanide treatment is not in some cases warranted by results.

Mr. James Johnston was not present to present his paper on "Mill and Metallurgical Practice of the Nipissing Mining Company," and as none of those present championed the cyanide method, there was no discussion.

Pyritic Smelting.

Mr. G. A. Guess presented a brief summary of his paper on "Pyritic Smelting." He called attention to some of the peculiarities of the process and to some of the advantages to be gained where it can be successfully applied. Dr. Peters made a few general comments on pyritic smelting.

Development of Reverberatory Furnace.

Dr. Edward D. Peters did not present a formal paper, but asked to be allowed to talk informally about the development of the reverberatory furnace and to later submit a more formal written discussion. The result was that the members had the privilege of listening to a very interesting historical account of the development of the furnace. Dr. Peters' experience goes back so far, and his study has been so thorough, that his mastery of his subject was clearly apparent.

In speaking of the reverberatory type of furnace, Dr. Peters emphasized the fact that it had its origin in Swansea, where, with an abundance of coal at hand for fuel, the reverberatory furnace had always held its own, while the Continental brethren had always stuck to the blast furnaces. He explained the construction of the reverberatory furnace, the faults which had been found in the earlier types, and the experiments which had resulted in the production of the present furnace 112 ft. in length, in which the ore is melted almost immediately it is thrown into the furnace, and the slag is drawn off without the loss of much heat.

Excursion Through Mount Royal Tunnel.

Thursday morning was spent in the Mount Royal tunnel, which is being constructed by the Canadian Northern Railway. The tunnel, a description of which was given in our Feb. 15 issue, is three miles long.

The members were divided into two parties. The first comprised those enthusiastic members who had made up their minds to walk through the first two miles of the tunnel—suitably attired in old clothes and rubber boots, and fearless of the eight or ten inches of water that they were warned beforehand would be encountered during the journey. The other party assembled an hour later and entered the tunnel by a shaft and made the trip to the western portals in trains drawn by electric locomotives.

The excursionists were conducted by S. P. Brown, chief engineer of the Canadian Northern Montreal Tunnel and Terminal Co., Ltd., and Dr. J. Austen Bancroft, professor of geology at McGill University.

Description of Methods of Excavation.

At the Thursday afternoon session Mr. Brown gave a well illustrated description of the methods of excavation in the Mount Royal tunnel. The methods of removing the broken rock quickly are especially interesting. The drill carriages proved quite successful.

Mr. Brown in opening pointed out that while, historically, tunneling antedated mining, it was most often employed as an operation in mining. Tunnelling, however, as commonly understood, differed from ordinary mining in that it usually consisted in driving a subterranean gallery, of definitely determined proportions, in a determined direction, without regard to mineral conditions encountered. The conditions of operation were therefore somewhat different, and often unsuited, to those usually adopted in mining work.

Another consideration is that while mining excavation normally pays the cost of operation, a tunnel is unproductive until it is completed, and thus the costs are cumulative. Time therefore became a prime consideration, as every million spent in costs represented an addition of 5 or 6 percent. in interest charges without return, while if other works, such as lines of railways, were awaiting the tunnel completion, the interest account may reach appalling proportions.

Mr. Brown then proceeded to describe and show the various scientific and mechanical means adopted to construct the tunnel in the minimum amount of time and with due regard to economy of construction. As indicating the close calculation possible, he mentioned that in an address at Toronto early in November he had said that the two ends of the tunnel were expected to meet by December 10th. The actual meeting occurred at 7 o'clock on the morning of December 10th.

Photographs of Cobalt Silver Veins.

Following Mr. Brown, Mr. A. A. Cole, of Cobalt, presented a number of slides showing with remarkable clearness some characteristic mineral and geological formations in the Cobalt district, including some of the famous veins from which millions of dollars in silver had been taken at various mines. The retiring president, Dr. Barlow, who occupied the chair, pointed out that Mr. Cole had been so successful with this class of photography that his pictures were now used by professors and lecturers in many leading schools of mining. Mr. Cole also showed some unique photographs which depicted graphically at half-hour periods the rapid spread of a forest fire.

A valuable paper on "Factors Influencing the Cost of Power" was contributed by Mr. J. McNeil Forbes, of Montreal.

Scientific Management.

This was followed by a series of slides illustrating the Taylor methods of scientific management. The lecturer, Mr. F. B. Gilbreth, of New York, explained that the devices shown were designed to measure efficiency and skill of operatives in various industries. The nine laws which governed modern scientific management of factories were summarized as follows: A task for every employee, standardization of methods of production, bigger pay for successful workers, smaller pay for unsuccessful workers, substitution of expert for non-expert workers, reducing the industry concerned to an exact science, hearty co-operation of all grades, and even division between managers and workers of responsibility for maintaining standardized conditions. Mr. Gilbreth then showed the ingenious devices perfected after years of experimentation, for

measuring the speed, the time, the direction and the relative dimensions of length, breadth and depth of the manual motions of workers. A point upon which he laid special stress was the elimination of unnecessary fatigue in the interests of the workers. Any unnecessary fatigue to which a worker was subject was not only a social crime toward the worker, but also a disadvantage to the employer, as lowering the employee's efficiency.

The Smoker.

Thursday evening a smoker was held in the ballroom. Chairman Col. Penhale conducted matters in his usual happy and successful manner, although his assumption of office and title was challenged by the president-elect.

Col. Penhale declared that he was Dean, and that the assemblage was a special convocation for the conferring of degrees on prominent members. Mr. Lindsey, in accepting a degree for one of the absent members, demanded first to know who in "convocation" Col. Penhale was, and how he got his robes of office. He referred to him as vice-chancellor; but the Colonel refused to be in any way associated with vice.

The victims of the convocation, and the degrees conferred, included: John Hardman, of Montreal, K.B.J.G.F. (Knocker but Jolly Good Fellow); Mr. Haultain (in absentia), G.A.G. (Grand Assaulter of Geologists); Dr. Bancroft, of McGill, G.S.B. (Grand Stone Buster); Eugene Coste, V.S. (Volcanic Secretionist); J. B. Tyrrell, of Toronto, A.R.O.C. (Artistic Romancer of Canada); and Dr. Barlow, of Montreal, R.I.P. (Rather Interesting President). The degrees were accompanied by inscribed addresses, in which the idiosyncrasies of the recipients were hit off most effectively. This was followed by a ludicrous burlesque on the discovery of the North Pole, in which various members of the Institute were mercilessly caricatured, and this again by a humorous illustrated narrative by Dr. Adams of an exploring expedition, in which many members took part.

On Friday morning several papers were presented. Mr. H. M. Payne, of New York, talked on "Efficiency Engineering Applied to Mining Quarries and Industrial Plants." Mr. W. McAlpine Johnson described a promising electric process for the treatment of zinc ores. Mr. A. Stansfield talked on "Recent Metallurgical Improvement," and Mr. H. Du Bois presented his paper on "High Carbon Steel Plates for Sluiceway Linings."

Efficiency Engineering.

Mr. H. M. Payne's ideas of the best way of improving methods are apparently quite different to those of Mr. Gilbreth.

"The best type of efficiency is common sense, taken frequently and in large doses. Inefficiency is the price of 'yes' and 'no.' Equipment regulates output and creates cost. Co-operation of employees increases output and decreases cost." These were the four epigrams which he called to the attention of members.

"I wish there were no such words in the English language as 'efficiency engineering,' or 'scientific management,'" he declared. "They have become so detested with most of us because, to the average man, they stand for red tape, increased clerical labor and routine. I am ready to grant that efficiency engineering can be applied with refinements of cruelty to stop watches; but the efficiency engineering I propose is to eliminate red tape, to make a man's work human instead of inhuman, to remember that pleasure in his work, is after all, the most important factor, and to eliminate, as far as possible, turning him into a human machine.

"You can buy a man's time and skill, but you cannot buy his co-operation. I agree that, in certain types of high grade skilled labor, it is possible to make motion studies to advantage, but my idea of efficiency engineering is not a colorless standardization, but rather an emphasized individuality. There is nothing mysterious or wonderful about efficiency engineering; it is nothing but plain, good horse-sense applied by a man who comes in from the outside and studies your problems free from the circular line of reasoning your are in, and free from the limitations of tradition that you are bound by."

The Johnson Electric Furnace.

Mr. W. McAlpine Johnson stated that he has produced an electric furnace which will allow of the treatment of the complex zinc ores similar to those of British Columbia on a commercial basis. This, if it is borne out by further exhaustive experiments on a larger scale will be a matter of great importance to the mining industry, and will allow of the extraction of the baser from the precious metals. The Government Department of Mines has been experimenting with other processes for years in order to make zinc smelting a profitable undertaking, but without any definite success. Mr. Johnson claims that he can produce more spelter by the use of less power than is found necessary in other countries, despite the fact that the ores in Canada are not of such a high grade as those of Norway and Sweden.

The president said if the problem had been solved the Dominion would be saved a lot of money and he thought a serious attempt should be made to take an inventory of the country's zinc resources, as well as iron.

Mr. W. R. Ingalls, who has been working for the Mines Department on the zinc question in Canada, said their warmest congratulations were extended to Mr. Johnson on the success of his experiments. At the present time he stood ahead of anybody in North America in his accomplishments. Serious experimental work had been carried on in Europe since 1898, and in Sweden and Norway electric zinc smelting was a process that was in operation, but they produced such an excessively large quantity of between products, and the inevitable expense attached to the resmelting of such products was so great that it was not a commercial success, although the electric energy required was extraordinarily cheap.

Prof. Stansfield also congratulated Mr. Johnson on his success, but had hoped that the power would have been reduced to 700 k. w. hours per ton of ore, instead of the 1,000 k. w. hours per ton he had mentioned as the quantity of electrical energy consumed.

Mr. Johnson said with a large furnace and better methods of handling, they would be able to get down to 700 k. w. hours per ton of ore.

Mr. Stansfield said if that was so the hope of making zinc smelting a commercial success was not ill-founded.

Recent Metallurgical Improvements.

Prof. A. Stansfield, Montreal, gave a resume of recent metallurgical improvements. He covered the most important advances in practice during the past 14 years, and showed the extent to which the mining profession was commercially dependent on the metallurgist. The metallurgical industry in Canada had

shown a wonderful development during this time, and there was great need for young men trained in Canadian universities to fill important positions, many of which are now filled by men from across the line. He also suggested that the Institute should follow the example of America and Britain and be renamed the Canadian Institute of Mining and Metallurgy.

Sluiceway Linings.

Mr. Howard W. DuBois, Philadelphia, Pa., gave a history of the use of high carbon steel plates for sluiceway linings in hydraulic mining, which, he said, had overcome the expense of heavy wear, and so decreased the cost of the sluiceway and increased the output by 25 per cent. by its smooth surface.

Diamond Mines of Kimberley.

Friday afternoon Mr. Gardner F. Williams gave a very interesting description of the Kimberley diamond fields and of the people. Mr. Williams has for many years been engaged in the industry and presented a well illustrated account of its development. He showed a very large collection of lantern slides and recounted many interesting experiences. He showed how the deposits were first worked, and how improvements were made as time went on. He called attention to the fact that all the diamonds come from the close proximity of the "pipes," which are supposedly of volcanic origin. He showed many specimens which suggest that the diamonds were originally in a crystalline rock, which has been decomposed.

A number of other papers were to be presented, but owing to lack of time only brief summaries were given, and several were not presented at all.

The Annual Dinner.

On Friday evening the members assembled in the ballroom of the Ritz-Carlton hotel for the annual dinner. Among the guests were Col. Sam Hughes, the Minister of Militia, and the Hon. Martin Burrell, Minister of Agriculture; Senator Bostock; Bradley Stoughton, secretary of the American Institute of Mining Engineers; Mr. White, secretary of the Conservation Commission, and Gardner F. Williams. Hon. Louis Coderre, Minister of Mines, was absent on account of illness. Colonel Penhale was toastmaster.

Col. Sam Hughes told the company he was there simply to renew his acquaintance with "the boys."

He spoke of the importance of the mining industry to the country, placing it next in importance to that of agriculture. Canada was a great and wonderful country to develop, and after visiting the northern regions he believed that Canada could not do better than send some of her best mining engineers into those remote areas to carry out prospecting work. No company could be expected to carry out real development in those regions under the existing conditions, and he would use his best endeavors to carry out the wishes of the Institute in any way he could to improve the industry.

The Minister of Agriculture drew a simile between mining and agriculture, and emphasized the need of continued progress being made in the science of geology to get the best results from the earth's treasures. The prosperity of the country must largely depend on agriculture, and he said that, unless that was put on a profitable basis, it would upset all the rest of the economic structure of the country. There was no other industry in Canada which had developed so greatly as the mining industry with so little State aid, and by the help largely of individual enterprise and intelligence. Its advance has been phenomenal, but it was only a small portion of what might be done in the future.

The retiring president expressed gratification that the Institute continued to grow in numbers and usefulness, and announced his conviction that, under the new president, the Institute would rise to greater heights of utility.

Senator Bostock said they were looking forward to a great revival in mining in the near future. They were suffering in British Columbia from speculations and it was hoped that every man interested in the mining industry would do all he could to prevent speculation in the development of that industry.

The president-elect, G. G. S. Lindsey, spoke on the welfare of the Institute, outlining as his policy during the coming year, the determination to enlist the support and co-operation of the mining and geological experts of Nova Scotia, and enlist them in the Institute. Their absence from membership was the one rift in the lute. He thanked Mr. Coderre for all that he had done for them as Minister of Mines, and added that they had great hopes for the future.

Among the interesting things said was the suggestion of Col. Penhale that the mantle of Minister of Mines could not fall on better shoulders than those of the Hon. George R. Smith, who is in the Legislative Council of Quebec, and whose appointment would give the greatest satisfaction to the mining interest in the Province, an expression of opinion that was enthusiastically endorsed.

The official part of the programme having been completed, the members at midnight adjourned to a smaller room and continued the evening's entertainment by impromptu speeches and stories. After a few hours everyone seemed to be satisfied, and the informal meeting came to an end.

CANADIAN MINING INSTITUTE—WESTERN BRANCH.

The following report of the Seventeenth General Meeting of the Western Branch of the Canadian Mining Institute, held in Vancouver, British Columbia, on February 19, has been taken from the Vancouver Daily News-Advertiser:

The question of the "wild-cat" was the first theme touched upon at the meeting yesterday in the Board of Trade rooms of the Western Branch of the Canadian Mining Institute. Mayor Baxter gave the lead to the consideration of it in his address of welcome and Mr. Jonathan Rogers, vice-president of the Vancouver Board of Trade, who extended a welcome on behalf of the Board, called attention not only to the "wild-cat" for which British Columbians might primarily be responsible, but for the overloading in London of a really good proposition until it too became as bad as a "wild-cat." He thought the time would come when there would have to be an exposure of the extortion of those in London who came between the man with the good proposition and the buyer.

The chairman agreed that more harm was done to mining in that way than by the "wild-cat," which in itself had no intrinsic value. Mr. W. Fleet Robertson, Provincial Mineralogist, described the "wild-cat" as a difficult one to tackle. He had very vivid recollections of two or three mines which had had long and honorable careers being at their inception regarded as "wild-cats."

Mineral Production in 1913.

The chairman, Mr. W. J. Sutton, quoted from the estimates of the Provincial Mineralogist to show that

the value of the mineral production in 1913 was a little more than $30,000,000; that the aggregate mineral production of the Province had reached the grand total of $460,000,000, and that more than 50 per cent. of that total had been produced in the last eight years.

The industry could be regarded as having made very satisfactory progress during what was considered by many as a very baneful year and, although the production was a little more than $2,000,000 less than in 1912, it was greater than in any previous year. There had been a decrease in the production of coal and copper, but an increase in the production of gold, silver, lead, zinc and coke.

The year's mining in each of the districts of the Province was reviewed and increased development work in practically every district noted.

Higher extraction of metals contained in the ores and low costs per ton of ore treated marked the year's work at the smelting works and the larger stamp mills operated in the Province. In Boundary district copper mines much ore that it was not possible to mine with profit some years ago had been shipped to the reduction works. There had been a substantial increase in the dividends paid by the metalliferous mines. The total of distributed profits of $2,390,000 was nearly double that paid in 1912.

Railway developments would greatly increase the mineral production of the Province, and the encouragement to prospecting in remote areas by the building of roads and trails was also noted.

Mr. W. Fleet Robertson stated that so far as he had been able to correct his estimate, placer gold would be 2 per cent. higher than stated in his "Preliminary Review"; copper would be two-thirds of one per cent. higher; the coal estimate was pretty nearly exact; coke was three-tenths of one per cent. lower; lode gold would be within one-tenth of one per cent. higher, and zinc would be about ten per cent. lower, because he had to now calculate only the amount shipped before the close of the year, which was less than that produced.

Accidents in B. C. Mines.

In a report on the mine accidents in 1913 by Mr. Thos. Graham, chief inspector of mines, the fatalities in coal mines were put at 27, one less than in 1912. In metalliferous mines the fatalities were 13, an increase of 5 over 1912. In the coal mines the ratio of fatal accidents per 1,000 persons employed was 4.05, compared with 3.93 in 1912; in metalliferous mines it was 3, compared with 2.10 for 1912. The use of non-freezing powders, Mr. Graham believed, would reduce the accidents from drilling into miss-holes in metalliferous mines. He also called attention to the usefulness of pulmotors even in metalliferous mines.

There was one mine inspector for every 1837 mine workers in British Columbia; in Great Britain the number of inspectors worked out at one for every 21,904 persons employed. Not more than 40 per cent. of the accidents was due to causes inherent in the business and unavoidable; 60 per cent. was due to the negligence of workers or lack of maintenance of proper discipline by responsible officials.

First Aid to the Injured.

In the afternoon Dr. Brydone Jack read an interesting address emphasizing the importance of St. John Ambulance Association first-aid training about mines, to which were attached notes by Mr. Thos. McGuckie, formerly general superintendent of the Western Fuel Company's mines, on mines rescue work. The chief mines inspector added the information that there was now one rescue apparatus for every 60 persons employed in mines in the Province.

Coal Mining in Nova Scotia.

After discussion of methods, there was read a paper by Mr. W. J.Dick, mining engineer to the Commission of Conservation, entitled "Notes on Coal Mining in Nova Scotia." The writer stated, in his introduction, that the paper had been presented for the purpose of giving to the coal operators on the Pacific Coast a brief resume of the outstanding features of coal mining practice in Nova Scotia. The paper was read by Mr. Thos. Graham, and was illustrated by lantern-slide views. After it had been discussed, Mr. Geo. Watkin Evans, of Seattle, gave a brief survey of the Alaskan situation.

Copper Mining on the Coast.

Copper was the subject at the evening session and the discussion on that and on mineral production of British Columbia generally, was studded with figures showing the enormous developments in recent years. The ten years ending 1913 showed an increase in mineral production of more than 100 per cent. The extensive new coast works of the Granby Co. were sketched and the prospects on Queen Charlotte Islands stated.

Granby Co.'s Activities.

In addition to describing the nature and extent of the developments of the Granby Consolidated Co. at Hidden Creek mines, near Granby bay, Mr. E. E. Campbell, one of the engineers of the company, gave interesting information as to the extension of the company's undertakings at other parts of the coast. During the past year and a half several new properties have been acquired, one at Valdes Island, Alaska, which consists of a fairly high grade copper ore. The company has completed its plans for the installation of a plant there and expects to start construction in the course of another month.

The company has also acquired the Mamie mine, on Prince of Wales island, Alaska, and has had men there doing development work and getting it into shape for producing in the spring. The company has also an option on a mine on Texada island, the Copper Queen, owned by the Van Anda Mining Co.

The Granby Co. has also purchased a lime quarry on Portland canal, and this is now in operation.

The company's property at Granby bay is 5,000 acres in extent, and includes a townsite. A complete reduction plant of three blast furnaces, having a capacity of 2,000 tons a day, has been put in.

Tassoo Copper Syndicate.

The first shipment of 500 tons to the smelter at Tacoma can be expected at the beginning of March from the Tassoo property, on Moresby island, of the Queen Charlotte group, which has been acquired by a syndicate, at the head of which is Mr. Robert R. Hedley, who described the property, and gave an account of the progress made to date.

CANADIAN MINING INSTITUTE—ROCKY MOUNTAINS BRANCH.

A meeting of the Rocky Mountains Branch of the Canadian Mining Institute is to be held at Fernie, Crowsnest pass, British Columbia, on March 18 and 19. Mr. W. R. Wilson, general manager for the Crow's Nest Pass Coal Co., Ltd., is chairman, and Mr. John

L. Stirling, Provincial Inspector of mines for Alberta, secretary.

The meeting will be opened in the morning of Wednesday, 18th inst., when the chairman will deliver an address, following which several papers will be read and discussed, as under:

1. "Mine-Rescue Apparatus," by Charles Graham, superintendent for the Corbin Coal and Coke Co., Corbin, B. C.

2. "Mechanical Equipment of Collieries," by N. C. Pitcher, Lethbridge, Alta.

3. "Certain Classes of Faults Encountered in the Crowsnest Pass District, with their Correlative Effects on Economic Mining," by W. R. Wilson.

4. "Shaft Sinking in Edmonton Coal Field," by E. I. Roberts, Evansburgh, Alta.

Papers read at earlier meetings of the branch, namely, those of J. Somerville Quigley, manager for the Hillcrest Coal and Coke Co., Hillcrest, Alta., on "Methods of Driving Pillars in Pitching Seams"; of C. C. Richards, of Edmonton, Alta., on "Field Notes for an Underground Survey"; of M. L. Hyde, on "Important Details in Connection with Construction of Colliery Plants"; of N. C. Pitcher, on "Preliminary Costs of Machinery for Colliery Work"; and of Francis Aspinall, district inspector of mines, Lethbridge, Alta., and Andrew A. Millar, manager for the Pacific Pass Coal Fields, Ltd., Fergie, Alta., on "Mine-Rescue Apparatus and the Value of Mine-Rescue Work," will also be open for discussion.

THE MINERAL PRODUCTION OF CANADA DURING THE YEAR 1913

A preliminary report by John McLeish, published by the Mines Branch, Ottawa.

The preliminary report on mineral production in Canada in 1913 presented herein shows a total value of production in the year just closed of $144,031,047. Although estimates have been made in some cases where complete returns were not available, it is probable that the final record will be a revision upward. The total value of the production in 1912 was $135,048,296, compared with which the 1913 output shows an increase of $8,982,751, or 6.65 per cent. In view of the large increase over all previous years made in mineral production in 1912 and the general trade depression and industrial restriction experienced during the latter part of 1913, the industry would appear to have made in the aggregate very satisfactory progress. The average production per capita in 1913 was $18.57, as against $18.27 in 1912 and $14.93 in 1910.

The production of the more important metals and minerals is shown in the following tabulated statement in which the figures are given for the two years 1912 and 1913 in comparative form, and the increase or decrease in value shown.

Of the total production in 1913 a value of $66,127,821, or 45.9 per cent. is credited to the metals and $77,903,226, or 54.1 per cent. to the non-metallic products. The increase over the value for 1912 in metallic products was $4,955,068, or 8.1 per cent., and in non-metallic products $4,027,683, or 5.45 per cent.

There was an increased production of each of the metals except copper and silver, the most important increase being in gold with 28 per cent. Pig iron increased 11.3 per cent. in tonnage, lead 5.3 per cent., and nickel 10.8 per cent. The falling off in copper was only 1.1 per cent. in quantity, although 7.6 per cent. in total value, and for silver 0.6 per cent. only in number of oz. and 2.3 per cent. in value, slightly lower average prices having been obtained for these metals.

Amongst non-metallic products increases are shown in all the important products except clays and lime. The largest increase was in natural gas, with 41 per cent. in value. The cement output was greater by 21 per cent. in quantity, asbestos 18 per cent., coal 4 per cent., gypsum 10.5 per cent., salt 6.04 per cent. In the case of petroleum there was a falling off of 6 per cent. in quantity, but on account of higher prices an increase of nearly 18 per cent. in total value.

Production of More Important Metals and Minerals in Canada in 1912 and 1913.

	1912		1913		Increase (*) or decrease (†) in value.
	Quantity.	Value.	Quantity.	Value.	
Copper, lb.	77,832,127	$12,718,548	76,975,832	$11,753,440	†$965,108
Gold, oz.	611,885	12,648,794	784,525	16,216,131	*3,567,337
Pig iron, tons	1,014,587	14,550,999	1,128,967	16,540,012	*1,989,013
Lead, lb.	35,763,476	1,597,554	37,662,703	1,754,705	*157,151
Nickel, lb.	44,841,542	13,452,463	49,676,772	14,903,032	*1,450,569
Silver, oz.	31,955,560	19,440,165	31,750,618	18,984,012	†456,153
Other metallic products	.....	864,343	.....	1,520,072	*655,729
Total	.....	$75,272,866		$81,671,404	*$6,398,538
Less pig iron credited to imported ores, tons	978,232	14,100,113	1,055,459	15,543,583	*1,443,470
Total metallic	.....	$61,172,753		$66,127,821	*$4,955,068
Asbestos and asbestic, tons	136,301	$3,137,279	161,086	$3,849,925	*$712,646
Coal, tons	14,512,829	36,019,044	15,115,089	36,250,311	*231,267
Gypsum, tons	578,458	1,324,620	639,698	1,477,589	*152,969
Natural gas, M. ft.	15,286,803	2,362,700	20,345,763	3,338,314	*975,614
Petroleum, brls.	243,336	345,050	228,080	406,439	*61,389
Salt, tons.	95,053	459,582	100,791	491,280	*31,698
Cement, brls.	7,132,732	9,106,556	8,658,922	11,227,284	*2,120,728
Clay products	.....	10,575,869	.....	9,673,067	†902,802
Lime, bush.	8,475,839	1,844,849	7,671,381	1,605,812	†2 39,037
Stone.	.....	4,726,171	.....	5,199,204	*473,033
Miscellaneous non-metallic	.....	3,973,823	.....	4,384,001	*410,178
Total non-metallic	.....	$73,875,543		$77,903,226	*$4,027,683
Grand total	.....	$135,048,296		$144,031,047	*$8,982,751

The decreases in clay products and lime were respectively 8.5 per cent. and 12.9 per cent.

The record of annual mineral production in Canada since 1886 shows the rapid growth of the industry, not only has the total output increased from a little over $10,000,000 in 1886 to its present output, but the average production per capita has increased from $2.23 per capita to $18.57, or eight times the rate shown by the first record.

Annual Mineral Production in Canada Since 1886.

Year.	Value of production.	Value per capita.	Year.	Value of production.	Value per capita.
1886....	$10,221,255	$2.23	1900....	$64,420,877	$12.04
1887....	10,321,331	2.23	1901....	65,797,911	12.16
1888....	12,518,894	2.67	1902....	63,231,836	11.36
1889....	14,013,113	2.96	1903....	61,740,513	10.83
1890....	16,763,353	3.50	1904....	60,082,771	10.27
1891....	18,976,616	3.92	1905....	69,078,999	11.49
1892....	16,623,415	3.39	1906....	79,286,697	12.81
1893....	20,035,082	4.04	1907....	86,865,202	13.75
1894....	19,931,158	3.98	1908....	85,557,101	13.16
1895....	20,505,917	4.05	1909....	91,831,441	13.70
1896....	22,474,256	4.38	1910....	106,823,623	14.93
1897....	28,485,023	5.49	1911....	103,220,994	14.42
1898....	38,412,431	7.32	1912....	135,048,296	18.27
1899....	49,234,005	9.27	1913....	144,031,047	18.57

The continuance during 1913 of the labor strike at the mines of the Canadian Collieries (Dunsmuir) Ltd., and its extension to the other collieries on Vancouver Island, seriously restricted the coal output from this district. The total value of the metals was also somewhat smaller than it might otherwise have been because of the slightly lower average prices obtained for copper and silver. A restricted demand was also reported during the latter part of the year for brick and other clay products and structural materials. While these are some of the influences that have tended to curtail the mineral output during the year, there have on the other hand been important increases in the production of gold, nickel, lead, among the metals, in asbestos, natural gas and many of the other lesser valuable non-metal products and in cement, resulting in the net increases already shown.

Mineral Production by Provinces, 1912 and 1913.

	1912		1913	
	Value of production.	Pct. of total.	Value of production.	Pct. of total.
*Nova Scotia	$18,922,236	14.01	$19,305,545	13.40
New Brunswick	771,004	0.57	1,049,932	0.73
Quebec	11,656,998	8.63	13,303,649	9.24
Ontario	51,985,876	38.50	58,697,602	40.75
Manitoba	2,463,074	1.83	2,211,159	1.54
Saskatchewan	1,165,642	0.86	899,233	0.62
Alberta	12,073,589	8.94	13,844,622	9.61
British Columbia	30,076,635	22.27	28,529,081	19.81
Yukon	5,933,242	4.39	6,190,224	4.30
Dominion	$135,048,296	100.00	$144,031,047	100.00

*Includes a small production of lime from Prince Edward Island.

The record of production by Provinces given in the accompanying table shows the relative importance of the several Provinces in practically the same order as last year, with the exception that Saskatchewan replaces New Brunswick in last position, due to a falling off in the coal and structural material production in the former Province and an increase in the coal, gypsum and natural gas production in the latter. Ontario has the largest output, with a value of $56,697,602, or 40.75 per cent. of the total, a slightly higher proportion than in 1912. British Columbia is second with a value of $28,529,081, or 19.81 per cent. of the total, a relative falling off; Nova Scotia takes third place, with a total production of $19,305,545, or 13.4 per cent.; Alberta fourth, with $13,844,622, or 9.6 per cent.; Quebec fifth, with $13,303,649, or 9.24 per cent.

Increases are shown in each of the Provinces with the exception of Manitoba, Saskatchewan and British Columbia. The largest increase—36 per cent.—is exhibited by New Brunswick. The increases in the other Provinces were respectively: Alberta, 14.7 per cent.; Quebec, 14.1 per cent.; Ontario, 12.9 per cent.; Yukon, 4.3 per cent.; Nova Scotia, 2.0 per cent. The decreases were: Saskatchewan, nearly 23 per cent.; Manitoba, 10 per cent., and British Columbia, 5 per cent.

It should be remembered in dealing with these comparisons that Nova Scotia in the above record is given no credit on account of the large iron smelting and steel making industries at Sydney, New Glasgow, etc. The pig iron made here is entirely from imported ore and naturally is not credited as a Canadian mine output. The same remark applies to a large percentage of the pig iron production in Ontario as well as to the production of aluminum in Quebec.

The Mineral Production of Canada in 1913.

Subject to Revision.

Product.	Quantity.	Value.
Metallic.		
Copper, value at 15.269c. per pound, lbs.	76,975,832	$11,753,440
Gold, oz.	784,525	16,216,131
Pig iron from Canadian ore, tons	73,508	996,429
Iron ore sold for export, tons	216,614	430,561
Lead, value at 4.659c. per pound, lb.	37,662,703	1,754,705
Nickel, value at 30c. per pound, lb.	49,676,772	14,903,032
Silver, value at 59.791c. per ounce, oz.	31,750,618	18,984,012
Cobalt and nickel oxides	.....	689,511
Zinc ore, tons	7,535	400,000
Total	.....	$66,127,821
Non-Metallic.		
Actinolite, tons	66	720
Arsenic, white, tons	1,692	101,463
Asbestos, tons	136,951	3,830,909
Asbestic, tons	24,135	19,016
Coal, tons	15,115,089	36,250,311
Corundum, tons	1,177	137,036
Feldspar, tons	15,935	56,841
Graphite, tons	2,162	90,282
Grindstones, tons	4,284	43,900
Gypsum, tons	639,698	1,477,589
Magnesite, tons	770	4,620
Mica, tons	.....	170,112
Mineral pigments—		
Barytes, tons	641	6410
Ochres, tons	5,987	41,774
Mineral water	.....	173,677
Natural gas, M. cu. ft.	20,345,763	3,338,314
Peat, tons	2,600	10,100
Petroleum, value at $1.782 per barrel, brls	228,080	406,439
Phosphate (returns not complete), tons	25	217
Pyrites, tons	228,811	638,185
Quartz, tons	78,261	169,842
Salt, tons	100,791	491,230
Talc, tons	12,250	45,980
Tripolite, tons	620	12,138
Total	.....	$47,517,155
Structural Materials and Clay Products.		
Cement, Portland, brls.	8,658,922	$11,227,284
Clay products—		
Brick, common, pressed, paving	.....	7,709,224
Sewerpipe	.....	920,973
Fireclay, drain tile, pottery, etc.	.....	1,037,870
Kaolin, tons	500	5,000
Lime, bush.	7,671,381	1,605,812
Sand and gravel	.....	1,712,256
Sand-lime brick	.....	962,004
Slate, sq.	1,432	6,444
Stone—		
Granite	.....	1,644,183
Limestone	.....	3,087,991
Marble	.....	250,373
Sandstone	.....	216,667
Total structural materials and clay products	.....	$30,386,071
All other non-metallic	.....	47,517,155
Total value, metallic	.....	66,127,821
Grand total, 1913	.....	144,031,047

The average monthly prices of the metals in cents per pound for several years past are shown herewith, and reference is made elsewhere to the changes in prices here shown in 1913 as compared with 1912. A peculiar feature of the changes is the fact that there was a falling off in the average price of lead on the New York market, but an increase in the average price in London.

Average Monthly Prices of the Metals (cents).

	1908.	1909.	1910.	1911.	1912.	1913.
Copper, New York	13.28	12.982	12.738	12.376	16.341	15.269
Lead, New York	4.200	4.273	4.446	4.420	4.471	4.370
Lead, London	2.935	2.839	2.807	3.035	3.895	4.072
Lead, Montreal*	3.364	3.268	3.246	3.480	4.467	4.659
Nickel, New York	43.000	40.000	40.000	40.000	40.000	40.000
Silver, New York	52.864	51.503	53.486	53.304	60.835	59.791
Spelter, New York	4.720	5.503	5.520	5.758	6.943	5.648
Tin, New York	29.465	29.725	34.123	42.281	46.096	44.252

*Quotations furnished by Thos. Robertson & Co., Montreal.

Smelter Production.

General statistics showing the quantities of ore treated at smelters and the quantities of refined metals or smelter products obtained have been collected by this branch since 1908. It should be explained that the accompanying statistics include the treatment of a small quantity of imported ores chiefly in the British Columbia smelters.

The total quantity of ore, concentrates, etc., treated in 1913 was 3,027,085 tons as compared with 3,005,410 tons in 1912.

The ores treated may be conveniently classified as follows:

Ores Treated in Canadian Smelters.

	1911.	1912.	1913.
Nickel-copper ores	610,834	725,065	823,403
Silver-cobalt-nickel-arsenic ores	9,330	8,097	5,818
Lead and other ores treated in lead furnaces	55,408	59,932	78,110
Copper-gold-silver ores	1,517,981	2,212,316	2,119,754
Total	2,193,553	3,005,410	3,027,085

The products obtained in Canada from the treatment of these ores include refined lead produced at Trail, B.C., and fine gold, fine silver, copper sulphate and antimony produced from the residues of the lead refinery there; silver bullion, white arsenic, nickel oxide and cobalt oxide produced in Ontario from the Cobalt district ores. In addition to these refined products blister copper, copper matte, nickel-copper matte, cobalt material or mixed cobalt and nickel oxides are produced and exported for refining outside of Canada.

The aggregate results of smelting and refining operations may be summarized as in the next table. Unfortunately the figures cannot be taken to represent the total production from smelting ores mined in Canada, since considerable quantities of copper and silver ores are still shipped to other smelters outside of Canada for smelting.

Products of Canadian Smelters.

a.	1912 b	1912 c	1913 b	1913 c
Gold, oz.	12,118	184,815	11,977	213,279
Silver, oz.	17,572,217	686,171	13,789,709	934,601
Lead (including secondary lead), lb.	35,893,190	.....	39,468,729	.....
Copper, lb.	.....	58,405,910	.....	59,245,722
do sulphate, lb	87,110	.....	130,533	.....
Nickel, lb.	.....	44,841,542	.....	49,676,772
*Nickel and cobalt oxides, etc., lb.	349,054	.....	1,644,185	.....
White arsenic, lb	4,090,768	.....	3,384,249	.....

aRefined products produced and metals contained in refined smelter products exported. bRefined products. cMetals contained in matte blister, base bullion and speiss. *Nickel oxide, cobalt oxide and cobalt material, speiss, etc., not all completely refined.

Smelter products shipped out of Canada for refining were blister copper carrying gold and silver values 15,270 tons in 1913, as compared with 17,063 tons in 1912, copper matte carrying gold and silver values 5,159 tons in 1913, as against 6,727 tons in 1912, and bessemer nickel-copper matte carrying small gold and silver values as well as metals of the platinum group 47,150 tons in 1913, as compared with 41,925 tons in 1912.

Gold.

The gold production of 1913 is estimated at $16,216,131, which compared with the production of the previous year shows an increase of $3,567,337.

The Yukon placer production in 1913 is estimated at $5,835,554, as against 5,576,493 in 1912, the total amount on which royalty was paid during the calender year according to the records of the Department of Interior being 352,900.04 oz. in 1913, and 335,015.67 oz. in 1912.

The British Columbia production in 1913 was $6,136,000, of which the placer production as estimated by the Provincial Mineralogist was $540,000. Smelter recoveries and bullion from milling ores being estimated as $5,596,900.

The main feature of the year was the large increase from the Porcupine district of Ontario.

British Columbia and the Yukon also show substantial increases, while the estimates for Nova Scotia and Quebec show decreases.

The export of gold bearing dust nuggets, gold in ore, etc., in 1913 were valued at $12,770,838.

Gold in bars, blocks, ingots, etc., were imported in 1913 to the value of $840,435.

Silver.

The estimated production of silver in 1913 was 31,750,618 fine oz., valued at $18,984,012, a decrease of 204,942 oz. and $456,153 from 31,955,560 oz. valued at $19,440,165 in 1912.

Of the 1913 production 28,452,737 oz. were from Ontario and 3,208,122 from British Columbia.

For British Columbia the figures represent the recovery in mill bullion or as silver contained in smelter products, while for Ontario the figures represent the silver contained in gold ores milled or smelted and in bullion shipments from Cobalt, to which is added the silver contents of the Cobalt ore and concentrate shipped, less five per cent. allowed for smelter losses.

The total shipments of ore and concentrates from the mines of Cobalt and the adjacent districts were about 44,106 tons, containing approximately 22,031,564 fine oz., in addition to which 7,482,833 fine oz. were shipped as bullion. Of this tonnage about half was treated in the camp itself in customs reduction works.

In Quebec the silver was derived from the pyritic ores of the Eastern Townships.

The exports of silver in ore, etc., as reported by the Customs Department were 37,371,569 oz., valued at $21,441,220. There was also an importation of silver in bars, blocks, sheets, etc., valued at $840,245.

The price of silver in New York varied between a maximum of 63¾ cents in January and a minimum of 56⅞ cents per oz. in March, the average monthly price being 59.791 cents per oz., compared with an average of 60.835 cents in 1912.

Copper.

The Canadian production of copper is represented by the copper contents of smelter products, matte, blister copper, etc., together with the amount of copper contained in ores exported, estimated as recoverable.

The total production on this basis in 1913 was 76,975,832 lb., valued at $11,753,440, as compared with 77,832,127 lb., valued at $12,718,548 in 1912, a decrease in quantity of 856,295 lb., and in value of $965,108.

Quebec Province is credited with a production of 3,455,887 lb., as against 3,282,210 lb. in 1912, the increase being due to the increased production from the pyritic ores of the Eastern Townships.

Ontario's production in 1913 was 25,884,836 lb., as compared with 22,250,601 lb. in 1912, being mainly derived from the nickel-copper ores of the Sudbury district.

British Columbia had an output of 45,791,579 lb.

From the Yukon the Pueblo mine was the heaviest shipper.

The New York price of electrolytic copper varied during the year between 17.45 cents per lb. in January and 14.05 cents in December, the average for the

year being 15.269 cents as against an average monthly price of 16.341 cents in 1912.

The total imports of copper in 1913 were valued at $7,415,008, divided into crude and manufactured 41,011,961 lb., valued at $6,935,822, other manufactures valued at $371,226, copper sulphate 2,037 lb., valued at $107,960.

The exports of copper were: Fine in ore, matte, etc., 81,879,080 lb., valued at $9,479,480, black in pigs 771,280 lb., valued at $123,431.

Lead.

The total smelter production of lead in 1913 was 39,468,729 lb., but this includes lead from American ores and lead contained in scrap, etc., re-smelted, the recovery from Canadian ores being 37,662,703 lb., valued at $1,754,705, an average of 4.659 cents per lb., the average wholesale or producer's price of pig lead in Montreal for the year.

In 1912 the production was 35,763,476 lb., valued at $1,597,554.

The shipments were practically all from British Columbia mines in 1913, though a small production is reported from Ontario and the Yukon.

The mines of British Columbia were very active during the year, and the total lead contents in ores shipped is estimated as slightly in excess of 54,000,000 lb. Allowing for "lag" and the losses due to smelting, the increased difference between ore contents and smelter recovery would indicate that a considerable amount of lead ore was in stock at the close of the year.

The exports of lead ore, etc., are given as 329,960 lb., valued at $9,136.

The total value of the imports of lead and lead products in 1913 was $1,215,434, including old scrap and pig 11,199,500 lb., valued at $464,117, manufactured lead 9,865,980 lb., valued at $320,797, manufactures N.O.P., $155,179, and litharge and lead pigments $275,341.

The average monthly price of lead in Montreal during 1913 was 4.659 cents. This is the producer's price for lead in car lots as per quotations kindly furnished by Messrs. Thos. Robertson & Co.

The average monthly price of lead in New York during the year was 4.370 cents, and in London £18.743 per long ton, equivalent to 4.072 cents per lb.

The amount of bounty paid during the twelve months ending December 31, 1913, on account of lead production was $57,956.70, as compared with $118,425.74 in 1912.

Nickel.

There was a greatly increased output in 1913 from the mining and smelting of the nickel-copper ores of Sudbury district, Ontario. The companies operating being the Canadian Copper Co. and the Mond Nickel Co., operating mines and smelters, and the British America Nickel Corporation developing its ore bodies. In addition shipments were made from the Alexo mine at Kelso Mines to the Mond smelter at Coniston.

During the year the Mond Nickel Company completed their new smelter at Coniston.

The ore is smelted to a Bessemer matte containing 77 to 82 per cent. of the combined metals, and shipped in that form to Great Britain and the United States for refining. A portion of the matte produced by the Canadian Copper Co. is used for the direct production of monel metal, an alloy of nickel and copper without the intermediate refining of either metal.

There is also a small recovery of nickel in the form of nickel oxide from the Cobalt district ores.

The total production of matte in 1913 was 47,150 tons, valued by the producers at the smelters at $7,076,945, an increase of 5,225 tons, or more than 12½ per cent. over the production of 1912. The metallic contents were copper, 25,875,546 lb. and nickel 49,676,772 lb. The amount of ore smelted was 823,403 tons, which included shipments from the Alexo mentioned above.

The aggregate results of the operations on the nickel ores during the past four years were as follows, in tons of 2,000 lb.

Production from Nickel-Copper Ores (in tons of 2,000 lb.)

	1910.	1911.	1912.	1913.
Ore mined	$652,392	$612,511	$737,584	$784,697
Ore smelted ...	628,947	610,834	725,065	823,403
Bessemer matte produced	35,033	32,607	41,925	47,150
Copper content of matte	9,630	8,966	11,116	12,938
Nickel content of matte	18,636	17,049	22,421	24,838
Spot value of matte . ..	$5,380,064	$4,945,592	$6,303,102	$7,076,945

Nickel Contained in Matte Exported (pounds).

Exported to				
Great Britain ..	5,335,331	5,023,393	5,072,867	5,164,512
United States ..	30,679,451	27,596,578	39,148,993	44,224,119
Other countries .	.....	.....	.....	70,386
	36,014,782	32,619,971	44,221,860	49,459,017

The price of refined nickel in New York remained constant throughout the year, quotations in the Engineering and Mining Journal, being for large lots, contract business 40 to 45 cents per lb. Retail spot from 50 cents for 500 pound lots up to 55 cents for 200 lb. lots. The price for electrolytic is 5 cents higher.

Iron.

Iron Ore.—The iron ore shipments from Canadian mines during 1913 amounted to 307,634 short tons, valued at $629,843. These shipments included 92,386 tons of hematite and roasted siderite, 209,886 tons of magnetite and concentrates and 5,362 tons of titaniferous ore.

The total ore shipments in 1912 were 215,883 short tons, valued at $523,315, and included 128,912 tons classed as magnetite, and 86,971 as hematite.

Exports of iron ore from Canada during 1913 were recorded by the Customs Department as 126,124 tons, valued at $426,681. These were from Ontario, New Brunswick, Nova Scotia and Quebec.

Imports of iron ore, according to Customs records, in 1913 were 1,942,325 tons, valued at $3,877,824.

Shipments from the Wabana mines, Newfoundland, in 1913 by the two Canadian mines operating there were 1,605,920 short tons, of which 1,048,432 tons were shipped to Sydney and 557,488 tons to the United States and Europe.

Pig Iron.—The total production of pig iron in Canadian blast furnaces in 1913 was 1,128,967 tons of 2,000 lb., valued at approximately $16,540,012, as compared with 1,014,587 tons, valued at $14,550,990 in 1912.

Of the total production of 1913, 23,696 tons were made with charcoal as fuel and 1,105,271 tons with coke.

The classification of the production, according to the purposes for which it was intended, was as follows: Bessemer 265,685 tons, basic 614,845 tons, foundry and miscellaneous 248,437 tons. The amount of Canadian ore used during 1913 was 139,436 tons, imported ore 2,110,828 tons, mill cinder, etc., 33,583 tons.

The amount of coke used during the year was 1,417,148 tons, comprising 710,260 tons from Canadian coal and 706,888 tons of imported coke or coke made from

imported coal. There were also used 2,206,191 bushels of charcoal. Limestone flux used amounted to 630,119 tons.

In connection with blast furnace operations, there were employed 1,589 men and $1,149,345 was paid in wages.

There was also a production in 1913 in electric furnaces of 8,075 tons of ferro alloys, valued at $493,018, compared with 7,834 tons, valued at $465.225 in 1912.

The exports of pig iron during the year are reported as 6,326 tons, valued at $351.646, an average of $55.58 per ton. Probably the greater part of this is ferro-phosphorus produced at Buckingham, and ferro-silicon and ferro-manganese produced at Welland.

There were imported during the year 253,843 tons of pig iron valued at $3,234,877, charcoal pig iron 926 tons, valued at $12,528, and ferro-manganese, ferro-silicon, etc., 30,355 tons valued at $940,443.

The Production of Pig Iron by Provinces in 1912-1913.

	1912			1913		
	Tons.	Value.	Value per ton.	Tons.	Value.	Value per ton.
Nova Scotia	424,994	$6,374,910	$15.00	480,068	$7,201,020	$15.00
Ontario	589,593	8,176,089	13.87	648,899	9,338,992	14.39
	1,014,587	$14,550,999	$14.34	1,128,967	$16,540,012	$14.65

The total sales of mill stock in 1913 were 131,291 tons, valued at $2,841,747, or an average of $21.64 per ton, as against 105,898 tons in 1912, valued at $2,227,-221, or an average of $21.03 per ton, a large increase in quantity, but at substantially the same average price.

There was a falling off in the amount of both crude and mill fibre in stock at the end of the year.

Output Sales and Stocks of Asbestos in 1913.

	Output.	Sales			Stock on hand Dec. 31.		
	Tons.	Tons.	Value.	Per ton.	Tons.	Value.	Per ton.
Crude No. 1	2,015.4	1,853.3	$531,200	$286.62	880.5	$247,877	$281.52
Crude No. 2	3,010	3,807	457,962	120.29	1,522	178,789	117.47
Mill stock No. 1	23,444	26,198	1,229,908	46.95	6,755	350,165	51.84
Mill stock No. 2	58,592	60,164	1,201,215	19.97	4,809	108,285	22.52
Mill stock No. 3	45,503	44,929	410,624	9.14	6,820	54,604	8.01
Total asbestos	132,564.4	136,951.3	$3,830,909	$27.97	20,786.5	$939,720	$45.21
Asbestic	.....	24,135	$19,016	$0.79	....	.....	.....

Output Sales and Stocks of Asbestos in 1912.

	Output.	Sales			Stock on hand Dec. 31.		
	Tons.	Tons.	Value.	Per ton.	Tons.	Value.	Per ton.
Crude No. 1	1,458.8	1,937.9	$510,154	$263.25	866.8	$221,289	$255.29
Crude No. 2	3,290	3,725	380,197	102.07	2,789	303,063	108.66
Mill stock No. 1	21,522	21,679	945,994	43.64	8,059	379,904	47.14
Mill stock No. 2	36,872	44,819	895,322	19.79	6,301	132,970	21.10
Mill stock No. 3	39,616	39,400	385,905	9.79	5,272	45,976	8.72
Asbestos	102,758.8	111,560.9	$3,117,572	$27.95	23,287.8	$1,083,202	$46.51
Asbestic	.....	24,740	$19,707	$0.80	....	.....	.....

Asbestos.

Activity in the production of asbestos in 1913 was confined to the districts of Black Lake, Thetford and Danville in Quebec. None of the quarries formerly operated at East Broughton were worked, although small shipments were made by one firm from stock.

The output and shipments in 1913 exceeded those of all previous years, the increase in sales over 1912 being 22.75 per cent.

The total output in 1913 was 132,564 tons, as against 102,759 tons in 1912, an increase of 29,805 tons, or 29 per cent. The sales and shipments of asbestos fibre in 1913 were 136,951 tons, valued at $3,830,909 or an average of $27.97 per ton as against sales in 1912 of 111,561 tons valued at $3,117,572 or an average of $27.95. Stock on hand at December 31, 1913 was reported as 20,786 tons as compared with stocks of 23,-288 tons at the beginning of the year.

The number of men employed in mines and mills was 2,951 and amount paid in wages $1,687,957.

The total quantity of asbestos rock sent to mills is reported as 2,110,990 tons, which with a mill production of 127,539 tons shows an average estimated content of about 6.04 per cent. of fibre in the rock.

A new mill is in course of construction at Danville.

The output and sales of crude and mill stock separately is shown for 1912 and 1913 in tabulated statements following. The classification is based on valuation, crude No. 1, comprising material valued at $200 per ton and upwards, and crude No. 2, under $200; mill stock No. 1 includes mill fibre valued at from $30 upwards, No. 2, from $15 to $30, and No. 3, under $15.

The total sales of crude in 1913 were 5,660.3 tons, valued at $989,162, or an average of $174.75, as against sales in 1912 of 5,662.9 tons, valued at $890,351, or an average of $157.22, practically the same quantity, but at a higher average price.

Exports of asbestos during the twelve months ending December 31, 1913, were 103,812 tons, valued at $2,848,047, as against 88,008 tons valued at $2,349,353 exported in 1912. There was also an export of manufactures of asbestos in 1913 valued at $73,446.

Coal and Coke.

The coal mining industry in Canada in 1913 was marked by an increased production in the Maritime Provinces of Nova Scotia and New Brunswick and in the Province of Alberta and a falling off in the Provinces of Saskatchewan and British Columbia. In the latter Province the decrease was entirely due to the continuance throughout the year of the labor strike in the mines on Vancouver island. The lessened production in these two Provinces was, however, more than offset by the increased output in Alberta and Nova Scotia, so that the net result for the year was an increase of about 602,260 tons, or 4.15 per cent.

The total production of marketable coal for the year comprising sales and shipments, colliery consumption and coal used in making coke, etc., was 15,115,089 short tons, valued at $36,250,311, as against 14,512,829 tons, valued at $36,019,044 in 1912. Nova Scotia shows an increase of 188,839 tons, or 2.4 per cent., Alberta an increase of 903.80 tons, or 27.9 per cent., Saskatchewan a decrease of 16,167 tons, or 7.1 per cent., and British Columbia a decrease of 494,548 tons, or 15.4 per cent. The figures for the Yukon represent for 1913 the production from the Tantalus field only, no record having as yet been received of the output below Dawson.

The production by Provinces during the past three years is given on the next page:

Production of Coal by Provinces.

Province.	1911		1912		1913	
	Tons.	Value.	Tons.	Value.	Tons.	Value.
Nova Scotia	7,004,420	$14,071,379	7,783,888	$17,374,750	7,972,727	$17,796,265
British Columbia .	2,542,532	7,945,413	3,208,997	10,028,116	2,714,449	8,482,653
Alberta	1,511,036	3,979,264	3,240,577	8,113,525	4,144,377	9,462,836
Saskatchewan	206,779	347,248	225,342	368,135	209,175	347,685
New Brunswick ..	55,781	111,562	44,780	89,560	70,311	140,622
Yukon Territory ..	2,840	12,780	9,245	44,958	4,050	20,250
Total	11,323,388	$26,467,646	14,512,829	$36,019,034	15,115,089	$36,250,311

The exports of coal in 1913 were 1,562,020 tons, valued at $3,961,351, as compared with exports of 2,127,133 tons valued at $5,821,593 in 1912, a falling off of 565,113 tons, or over 26 per cent.

Imports of coal during the year included bituminous, round and run of mine 10,743,473 tons, valued at $21,756,658; bituminous slack 2,816,423 tons, valued at $4,157,622; and anthracite 4,642,057 tons, valued at $22,034,839; or a total of 18,201,953 tons, valued at $47,949,119.

The imports in 1912 were bituminous, run of mine, 8,491,840 tons, valued at $16,846,727; bituminous slack 1,915,993 tons, valued at $2,550,992 and anthracite 4,184,017 tons, valued at $20,080,388, or a total of 14,595,810 tons, valued at $39,478,037.

Thus the increase of imports of coal in 1913 amounted to a total of 3,606,143 tons, or nearly 25 per cent. The increase in the imports of bituminous run of mine being 2,251,633 tons, or 26.5 per cent., increased imports of slack 900,430 tons, or 47 per cent., increased imports of anthracite 458,040 tons, or 11 per cent.

The apparent consumption of coal during the year was 31,685,456 tons, as against a consumption of 26,934,800 tons in 1912. Of the consumption in 1913 about 42.8 per cent. was from Canadian mines and 57.2 per cent. imported.

Coke.—The total output of oven coke during 1913 was 1,157,133 tons of 2,000 lb. made from 2,147,913 tons of coal, of which 1,598,912 tons were mined in Canada and 549,001 tons imported. The total quantity of coke sold or used by the producers during the year was 1,530,499 tons, valued at $5,547,694.

In 1912 the total output was 1,406,028 tons, and the quantity sold or used by the producers 1,411,229, valued at $5,164,331.

The output by Provinces in 1913 was: Nova Scotia 920,526 tons, Ontario 411,643 tons, Alberta, 65,104 tons and British Columbia 319,860 tons. That of Ontario was entirely from imported coal.

By-products from coke ovens recovered during the year included 10,608 tons ammonia sulphate; 8,371,600 gallons of tar and 3,353,731 thousand feet of gas, and the total value would approximate $866,150.

The ovens of the Acadia Coal Co. and Londonderry Iron & Mining Co. in Nova Scotia, the Atikokan Iron Co. in Ontario, the West Canadian Collieries and Leitch Collieries in Alberta, and the Canadian Collieries, Ltd., in British Columbia were idle throughout the year. At the end of the year there were 1,720 ovens in operation and 1,325 idle, as follows: Nova Scotia 572 active, 376 idle; Ontario 110 active, 100 idle; Alberta 134 active, 233 idle; British Columbia 904 active, 426 idle.

The exports of coke during 1913 were 68,235 tons, valued at $308,410, and the imports 723,906 tons, valued at $2,180,830. In 1912 the exports were 57,744 tons, valued at $252,763, and the imports 628,174 tons, valued at $1,702,856.

Petroleum and Natural Gas.

The production of crude petroleum in Canada was still confined during 1913 to the old established fields in Ontario, with a few barrels pumped from gas wells in New Brunswick.

The annual output has been steadily declining during the past six years, and shows a further falling off in quantity produced in 1913, although owing to the higher price obtained for oil a larger total value is shown than for 1912.

A bounty of one and a half cents per imperial gallon is paid upon the production of crude petroleum, the Bounty Act being administered and payments made by the Department of Trade and Commerce. According to the records of this department the total output of petroleum in 1913 was 228,080 barrels, or 7,982,798 gallons, on which a bounty of $119,741.97 was paid. The total value of the production at the average price for the year, $1.782 per barrel, was $406,439.

The production in 1912 was 243,336 barrels, or 8,516,762 gallons, valued at $345,050, or an average value of $1.418 per barrel.

The average price per barrel at Petrolia during 1913 increased from a minimum on January 1 of $1.65 to $1.75 on April 16, $1.84 on November 6, and $1.89 on December 22.

The production in Ontario by districts as furnished by the Supervisor of petroleum bounties was in 1913 as follows, in barrels: Lambton 155,747, Tilbury 26,824, Bothwell 34,349, Dutton 4,610, Onondaga 4,172, and Belle River 464, or a total of 226,166 barrels. In 1912 the production by districts was: Lambton 150,272, Tilbury 44,727, Bothwell 34,486, Dutton 4,335, and Onondaga 7,115, or a total of 240,935 barrels.

The production in New Brunswick in 1913 was 2,111 barrels, as against 2,679 barrels in 1912 and 2,461 barrels in 1911.

Exports entered as crude mineral oil in 1913 were 3,650 gallons, valued at $379, and refined oil 24,273 gallons, valued at $3,188. There was also an export of naphtha and gasolene of 17,875 gallons, valued at $4,284.

The total value of the imports of petroleum and petroleum products in 1913 was $13,339,326, as against a value of $11,978,053 in 1912. The imports have been increasing rapidly during the past few years.

Crude oil is being extensively used as a fuel on the Pacific Coast in both steamships and locomotives, and the wide use of the gasolene motor has created a big demand for gasolene. The total imports of petroleum oils, crude and refined, in 1913, were 222,779,293 gallons, valued at $13,230,429, in addition to 1,628,837 lb. of wax and candles, valued at $108,897. The oil imports included crude oil 162,062,202 gallons, valued at $5,250,835; refined and illuminating oils 19,393,627 gallons, valued at $1,386,440; gasolene 29,525,170 gallons valued at $4,822,941; lubricating oils 6,789,451 gallons, valued at $1,172,986, and other petroleum products 5,008,844 gallons, valued at $597,227.

The total imports in 1912 were 186,787,484 gallons of petroleum oils, crude and refined, valued at $11,858,533, in addition to 2,144,006 lb. of paraffin wax and candles, valued at $119,520. The oil imports included: Crude oil 120,082,405 gallons, valued at $3,996,842; refined and illuminating oils 14,748,218 gallons, valued at $1,012,735; gasolene 40,904,598 gallons, valued at at $5,347,767; lubricating oils 6,763,800 gallons, valued at $1,077,712, and other petroleum products 4,288,463 gallons, valued at $423,477.

There was an increased importation in 1913 of all classes of oil with the exception of gasoline, the increases being most pronounced in crude oil and refined illuminating oil.

Natural Gas.—There was comparatively little change in the production of natural gas in Ontario, but a large increase in the production of New Brunswick and in Alberta. The total production in 1913 was approximately 20,345 million ft., valued at $3,338,314, of which 828 million ft., valued at $174,006, was from New Brunswick; 12,487 million ft., valued at $2,092,400 from Ontario, and 7,030 million ft., valued at $1,071,908 from Alberta.

The production in 1912 was reported as 15,287 million ft., valued at $2,362,700, and included 174 million ft. from New Brunswick, valued at $36,549; 12,529 million ft. from Ontario, valued at $2,036,245, and 2,584 million ft. from Alberta, valued at $289,906.

These values represent as closely as can be ascertained the value received by the owners or operators of the wells for gas produced and sold or used. The values do not represent what consumers have to pay, since in cases where transmission is by separately operated pipe line companies such cost is not included.

Cement.

The financial stringency during 1913 had an immediate effect in the restriction of building operations of all kinds and its results are shown in the statistics of production and consumption of structural materials. In the case of cement, while a very substantial increase in production is shown, this has seemed chiefly to displace imported material, the increase in consumption being only 4 per cent., as against an increased production of 24 per cent. Canadian mills supplied over 97 per cent. of the consumption in 1913, as against 83 per cent. in 1912. The industry has been marked by the extension of old and the completion of new plants, the latter west of the Great Lakes. The total capacity of completed plants at the end of the year being about 50,000 barrels per day, as compared with 36,500 barrels at the end of 1912. New plants were placed in operation at Winnipeg, Marlboro, west of Edmonton, Princeton, B.C., and at Tod Inlet, Vancouver Island, B.C. The plants of the Imperial Portland Cement Co. at Owen Sound and of the Crown Portland Cement Co. were not operated during the year.

The total quantity of Portland cement, including slag cement and natural Portland made in 1913 was 8,880,983 barrels, an increase of 1,739,979 barrels or 24 per cent. over 1912. The quantity of Canadian cement sold or used was 8,658,922 barrels valued at $11,227,284 or $1.29 2/3 per barrel, an increase of 1,526,190 barrels or 22 per cent. and $2,120,728 or 23 per cent. in total value. The total imports of cement were 889,324 cwt. equivalent to 254,092 barrels of 350 lb. each and valued at $409,303 or an average of $1.61 per barrel, as compared with imports of 1,434,413 barrels valued at $1,969,529 or an average of $1.37 in 1912. The total consumption of Portland cement, therefore, neglecting a small export was 8,913,014 barrels as compared with a consumption of 8,567,145 barrels in 1912, an increase of 345,869 barrels or only 4 per cent.

The average price per barrel at the works in 1913 was $1.29 2/3 as compared with $1.28 in 1912 and $1.34 in 1911 and 1910.

The imports of cement in 1913 included 77,356 barrels from Great Britain, 172,298 barrels from the United States, 3,443 barrels from Hong Kong and 995 barrels from other countries. The average price per barrel was $1.61 as against an average of $1.37 on imports in 1912.

The consumption of Portland cement during each of the past five years was as follows:

Annual Consumption of Portland Cement.

Calendar Year.	Canadian. Brls.	Pct.	Imported. Brls.	Pct.	Total. Brls.
1909	4,067,709	97	142,194	3	4,209,903
1910	4,753,975	93	349,310	7	5,103,285
1911	5,692,915	90	661,916	10	6,354,831
1912	7,132,732	83.3	1,434,413	16.7	8,567,145
1913	8,658,922	97.1	254,092	2.9	8,913,014

Production of Cement in Canada (barrels).

	1910.	1911.	1912.	1913.
Portland cement sold	4,753,975	5,692,915	7,132,732	8,658,922
Portland cement manufactured	4,396,282	5,677,539	7,141,004	8,880,983
Stock on hand January 1	1,189,731	918,965	894,822	866,138
Stock on hand December 31	832,038	903,589	903,094	1,088,199
Value of cement sold	$6,412,215	$7,644,537	$9,106,556	$11,227,284
Wages paid	1,409,715	2,103,838	2,623,902	.....
Men employed	2,220	3,010	3,461	.....

Exports of Mine Products, 1913.

	Quantity.	Value.
Arsenic, lb.	2,606,767	$107,094
Asbestos, tons	103,812	2,848,047
Asbestos sand, tons	24,766	138,737
Coal, tons	1,562,020	3,961,351
Feldspar, tons	15,966	62,767
Gold, dollars	.....	12,770,838
Gypsum, tons	417,302	504,383
Copper, fine, in ore, etc., lb.	81,879,080	9,479,480
Copper, black, in pigs, etc., lb.	771,280	123,431
Lead, metallic, in ore, etc., lb.	329,960	9,136
Nickel, in ore, etc., lb.	49,459,017	5,195,560
Platinum, oz.	158	7,929
Silver, oz.	37,371,569	21,441,220
Mica, lb.	817,152	240,775
Mineral pigments, cwt.	39,124	18,931
Mineral water, gals.	3,640	526
Oil, mineral, crude, gals.	3,650	379
Oil, mineral, refined, gals.	24,273	3,188
Ores—		
Corundum, tons	1,077	121,741
Iron, tons	126,124	426,681
Manganese, tons	8	303
Other ores, tons	10,835	658,808
Plumbago, cwt.	32,842	85,368
Pyrites, tons	46,066	211,640
Salt, cwt.	4,609	3,047
Sand and gravel, tons	644,633	440,956
Stone, ornamental, tons	1,942	687
Stone, building, tons	191,981	82,646
Stone, crushed, tons	4,814	3,126
Other articles, dollars	.....	124,392
Total value of exports of mine products	.....	$58,073,167

MINERAL PRODUCTION OF ONTARIO, 1913*

By T. W. Gibson

The total output of 1913 was again the largest in value in the history of the mining industry of Ontario. Compared with that of 1912 it shows an increase of 9.6 per cent., and with the output of 1911, an increase of 26.2 per cent.

In computing the values of the several products, the basis adopted remains the same as heretofore, viz., the selling value at the point of production and in the form produced. If credit were taken for the value of the nickel and copper at the prices of the refined metals, the aggregate production would be materially greater. For purposes of comparison with former years, and for what seem to be sound statistical reasons, the method which has always been employed in computing values is retained.

The figures are compiled from returns made to the Bureau of Mines by the owners or operators of mines, works and quarries under section 170 of the Mining Act of Ontario. Owing in part to the fact that smelter settlements for ore shipments made towards the close of the year are in some cases not received until after 15th January—the date when the returns are required to be forwarded—and in part to the dilatoriness of a few producers, the results are necessarily subject to revision, in the light of fuller information. It is believed, however, that in their final form the statistics for the year will not materially differ from those given herewith.

Metals.

There was an increase in the value of the metallic output as compared with 1912, of $2,708,812, or 7.7 per cent. More than three-fourths of the total production of metals came from the nickel-copper, silver and gold mines of northern Ontario, which now constitute the chief stay of the Province's mining industry. The remainder is furnished by pig iron, made principally from imported ore. It is recognized that the extensive pre-Cambrian area of north Ontario, which has already shown so much richness, affords a most promising field for exploration, and it is perhaps not too much to hope that other Sudburys, Cobalts, Porcupines and Moose Mountains or Helens will yet be brought to light.

Gold.—There were 16 producing gold mines in 1913, 7 of which were in Porcupine, and 9 elsewhere. The Porcupine mines yielded 207,583 oz. of gold, or more than 94 per cent. of the whole production. Hollinger crushed 138,291 tons of ore for a yield of 118,558 oz., the average contents recovered per ton for the year being .857 oz. At the Dome 131,149 tons were treated and 59,912 oz. of gold obtained, the average recovery per ton being .456 oz. The mill at the Dome mine is being enlarged and its capacity increased from 40 to 80 stamps. The completed mill is expected to be in operation during the spring of 1914. There were 5 other producers at Porcupine, the principal of which were Porcupine Crown and McIntyre-Porcupine. In their combined operations they treated 53,705 tons of ore, which turned out 29,093 oz. of gold, or an average yield per ton of .541 oz.

From the other gold districts, the production was as follows: Kirkland Lake and Swastika, 4,183 oz., Long Lake, 5,879 oz., Larder Lake, 700 oz., Eastern Ontario, 1,065 oz., and Northwestern Ontario, 1,262 oz.

Much attention is being given to Kirkland Lake, where is situated the Tough-Oakes mine. From this property 101,049 tons of selected ore were shipped, which contained a gross value of $46,685 or $462 per ton. In addition 1,975 tons of lower grade material were put through a small stamp mill and $26,232.31 in gold recovered, or $13.28 per ton. The veins at Kirkland Lake, which are quite narrow, are found in Timiskaming conglomerate and graywacke in contact with porphyry, and also in the latter. The Tough-Oakes and other claims have been acquired by English capitalists and the district is likely to be thoroughly tested.

Silver.—The production at Cobalt was a little less than in 1912, being 29,681,975 fine oz. as against 30,243,859—a decrease of 561,884 oz., or 1.85 per cent. High-water mark in this camp was apparently reached in 1911, when the yield was 31,507,791 oz. The process of decline is proving more gradual than did that of increase, the falling-off in two years being only 5.7 per cent. The price of silver last year was lower than in 1912, the average in New York for the twelve months being 59.791 cents per fine oz. as compared with 60.835 cents. The result was to reduce the return to the mining companies by $853,934, the value of the output being $16,555,001.

To obtain the total yield of silver, there should be added to the Cobalt output 42,956 oz. recovered from the auriferous ores of Porcupine and the other gold camps.

The life of the camp is being prolonged by the discovery of new veins, by the drainage of lakes so as to permit a more complete recovery of the deposits underlying them, and by an increasingly extensive concentration of low grade ore. Important veins were found last year when Kerr lake was drained, and a promising find was made in February, 1914, on the old Kerry lease in the bed of Peterson lake; the drainage of Cobalt lake is about to be begun; and a new 80 stamp concentration plant has been built to take the place of the Northern Customs plant, sold to an English syndicate, which has taken over the Cobalt Townsite and other mines.

The list of chief producers in 1913 is pretty much the same as the corresponding list for 1912. The ten leading mines were:

Nipissing	4,820,411 oz.
Coniagas	3,252,566 oz.
La Rose	2,592,775 oz.
Cobalt Townsite	2,314,602 oz.
McKinley-Darragh-Savage	2,228,832 oz.
Kerr Lake	2,072,407 oz.
Crown Reserve	1,776,678 oz.
Buffalo	1,752,199 oz.
O'Brien	1,240,931 oz.
Seneca-Superior	1,124,577 oz.

The only new name on this list is that of Seneca-Superior, which takes the place of Timiskaming. Nevertheless, there are some changes in precedence. The three leaders in 1912 are again at the head and in the same order, but Cobalt Townsite moves up to fourth place, Crown Reserve drops from fourth place to seventh, and O'Brien, which was tenth in 1912, is now ninth.

Of the whole production of silver, 28,105,505 oz. came from the mines of Cobalt proper, the yield from

*A Preliminary Report published by the Department of Lands, Forests and Mines, Ontario.

the outlying camps being as follows:

	oz.	oz.
Gowganda—		
Miller-Lake O'Brien	469,923	
Mann	32,447	
		502,370
South Lorrain—		
Wettlaufer-Lorrain		248,992
Casey—		
Casey Cobalt		825,108
Total		1,576,470

The shipments of ore and concentrates have ceased to be an index of the output at Cobalt, since so large a proportion of the silver is now produced in the form of bullion. At the Nipissing mine both high grade and low grade ores are now refined into merchantable bars, the high grade mill treating not only the output of the Nipissing mine, but also a large tonnage of similar material from other mines of the camp. The shipments for 1913 were as follows:

Ore.	Tons.	Oz.
Ore	9,495	13,668,079
Concentrates	11,017	9,014,633
Bullion	....	6,999,263

The silver refineries outside of Cobalt have been reduced in number by two, the plant owned and operated by the Canadian Copper Co. at Copper Cliff having been closed, and the works of the Canada Smelting and Refining Co. at Orillia having been burned down. The refineries at Deloro and Merritton owned respectively by the Deloro Mining and Reduction Co. and the Coniagas Reduction Co., continued in operation throughout the year. The Metals Chemical Co., of Welland, and the Dominion Refineries, of North Bay, also treated small quantities of ore. There were recovered and marketed by these works the following products.

Silver	oz.	11,345,128
White arsenic	lb.	2,450,758
Cobalt oxide	lb.	662,060
Nickel oxide	lb.	232,255
Cobalt and nickel oxides not separated	lb.	236,325

In addition to the cobalt oxides obtained by these refining plants, a considerable tonnage of residues was shipped by the Nipissing mine containing cobalt and nickel. The Canadian sources of cobalt oxide supply are now in control of the world's trade in this article. Under the provisions of the Metal Refining Bounty Act (7 Edw. VII., chapter 14), there was paid to the refining companies bounty amounting to $9,659.06 on refined cobalt oxide, and $4,703.53 on refined nickel oxide, produced in 1912. The bounty rate is six cents per pound on the metallic equivalent of the oxides.

Nickel.—The quantity of ore smelted at the nickel-copper works in 1913 was 823,403 tons, which produced 47,150 tons of bessemerized matte. The nickel contents amounted to 24,838 tons, valued in the matte at $5,237,477. In 1912, the production was 22,421 tons, worth $4,722,040, the increase being therefore a little under 11 per cent.

The operating companies are the Canadian Copper Co., and the Mond Nickel Co. Of the ore treated by the former, 418,525 tons were taken from the Creighton mine, 54,646 from Crean Hill, 56,439 from No. 2, and 86,665 from No. 3. The last mentioned mine is also known as the Frood. The Mond Co.'s ore was derived as follows: From the Garson mine, 113,403 tons; from Victoria No. 1, 38,592 tons; from North Star, 11,294 tons, and from Worthington, 537 tons. This company also received and smelted 4,596 tons of ore from the Alexo mine in the township of Dundonald, on the line of the T. & N. O. Railway, the product of which is similar in character to that of the Sudbury mines. The Mond Co. during the year removed their smelting plant from Victoria Mines to Coniston, some eight miles east of Sudbury, where they have erected a complete and well equipped plant. The British America Nickel Corporation have acquired the holdings of the old Dominion Nickel-Copper Co., and are developing the Murray and Whistle mines. They raised no ore during the year.

The satisfactory results obtained by diamond drilling at the Murray, Frood, Garson, Levack and other properties, disclosing, as they have, immense reserves of ore, have established nickel mining in Ontario on an assured basis.

Copper.—The matte produced at the Sudbury nickel-copper smelters furnished the only copper obtained in 1913, save for about 3 tons, which accompanied some concentrates shipped from the Timiskaming silver mine, Cobalt. The quantity was 12,941 tons, valued in the matte at $1,840,492. This compares with 11,126 tons in 1912, worth $1,584,310, an increase of about 16 per cent. The percentage of the copper to the nickel in the Sudbury matte last year was a little over 1 to 2.

Iron Ore and Pig Iron.—There were shipped from the iron mines of the Province last year 195,937 tons, valued at $424,072. Of this quantity 165,454 tons were of ore as taken from the mine, the remaining 30,483 tons were composed of 22,327 tons of roasted siderite from the Magpie mine, 4,841 tons of concentrates from the Trenton plant of the Canada Iron Mines, and 3,315 tons of briquettes from the Grondal magnetic concentrating works at Moose Mountain. The latter mine, it is stated, will be in a position to ship 200,000 tons to the United States market in 1914. At the Magpie mine the Algoma Steel Corporation are enlarging the capacity of the roasting plant which was erected to treat the siderite ore of which that deposit is composed.

That the producing capacity of the iron mines of Ontario has not kept pace with the expansion of the blast furnace industry is evident from the fact that of 1,228,269 tons of ore smelted into pig iron last year in Ontario, only 132,708 tons, or 10.8 per cent., were of domestic origin. The remainder was imported from the United States. One reason for this is the immense supply of first-class ore to be had from the Mesabi, Vermilion and other Lake Superior ranges south of the international boundary line; another is the fact that the ores of a considerable proportion of the known deposits in Ontario require beneficiation before they can be smelted.

The output of pig iron continues to grow, the product of the furnaces being 648,899 tons in 1913, worth $8,719,892, as against 589,593 tons in 1912, valued at $8,054,369—an increase of 10 per cent. in quantity and 8 per cent. in value. There are now eleven blast furnaces in the Province; of these only one, that of the Atikokan Iron Co. at Port Arthur, was not in operation in 1913. During the year two new furnaces were blown in—one by the Canadian Furnace Co., Port Colborne, and the other by the Standard Iron Co., at Parry Sound. The last named uses charcoal as fuel.

Non-Metals.

The output of non-metallic products had a value of $15,491,002, as against $13,541,869 in 1912—a gain of $1,949,133, or 14.3 per cent.

The increase was general throughout the list. Out of 24 products, five showed a decrease aggregating $190,037, while the remaining 19 increased by $2,139,170.

The largest falling off was in corundum, $96,176; quartz receded by $48,716, drain tile by $27,874, arsenic by $15,151 and mica by $2,120.

On the other hand, Portland cement advanced by $739,796, pressed brick by $237,122, stone by $163,314, natural gas by $160,859, sewer pipe by $135,670, common brick by $105,644, iron pyrites by $100,644, etc. Three of the Canada Cement Co.'s plants were shut down about the beginning of 1914, and will not likely be opened again this year.

Sand and gravel, of which statistics are given for the first time, show a production value of $229,967.

It is noteworthy that although the output of petroleum continues to decline—the reduction in 1913 as compared with 1912 being 516,969 gallons—the value was greater by $53,514.

Construction materials, as a whole, including brick of all kinds, lime, stone and cement, had an increased production of $1,275,937, or 14.6 per cent., as follows:

Product.	1912.	1913.
Bricks.	$4,034,405	$4,398,304
Lime.	381,672	399,600
Stone.	953,839	1,117,153
Cement.	3,365,659	4,105,455
Total.	$8,735,575	$10,011,512

Notes.

Water Power.—The mines and metallurgical plants of northern Ontario are now for the most part operated by electricity generated by water powers. This is true of Cobalt, where falls and rapids on the Montreal and Matabitchewan rivers are utilized; of Sudbury, where the mines and smelters are supplied with power by the Spanish, Wahnapitae and Vermilion rivers; of Porcupine, to which power is conducted from the Mattagami; of Michipicoten, where the Michipicoten and Magpie hoist the ore and operate the machinery at the Helen and Magpie mines; of the Canadian Exploration Co.'s gold mine at Long Lake, and of others. A new water power installation is being put in at Gowganda Lake to operate the Miller-Lake O'Brien silver mine, and a transmission line is under construction from the Blanche river at Charlton to work the gold properties in the new field at Kirkland Lake. Water powers are numerous in northern Ontario, and, as at Iroquois Falls, on the Abitibi river, are employed also to operate pulp and paper mills. They have been of great service to the mining industry in providing cheap power.

Profits.—The silver mining companies at Cobalt distributed over nine million dollars in dividends in 1913, raising the total since the beginning of the camp to nearly 50 million dollars. Adding profits to private owners, the whole distribution so far has been about 55 million dollars. The Hollinger gold mine during the twelve months paid out dividends amounting to $1,170,000, making a total since the opening of the mine of $1,440,000. Including nickel, construction materials, natural gas and other mineral products, the aggregate profits derived from the mining industry of the Province last year could not have been less than 15 million dollars.

SYSTEMATIC TIMBERING IN COAL MINES.

Owing to there having been a marked increase in fatalities from falls of roof and coal in coal mines in British Columbia, a circular letter, as under, was last year sent by the Chief Inspector of Mines to all coal mine managers in that Province:

"For a number of years past the percentage of total accidents from falls of roof and coal at the working faces has ranged from 35 to 60 per cent. of the total accidents due to the industry.

"I regret to say that during the first five months of the present year there have been 12 fatal accidents—or three more than during the whole of last year—from these causes.

"Owing to the large increase in this class of accident, the Hon. the Minister of Mines deems it necessary to avail himself of the powers given to him as set forth in Sec. 101 of the Coal Mines Regulation Act, and proposes in writing to the managers of the various collieries a special rule covering the question of 'Systematic Timbering and Spragging' at the working face.

"Recognizing that owing to the widely varying conditions in the different collieries in the Province—even in the same field, and often in the same mine—that a hard and fast rule on systematic timbering would render such rule often impracticable, making the same invalid and even often tending to bring about the very conditions it would be aimed to prevent; therefore, before formulating any such rule, the Minister, in keeping with his former policy, would like to avail himself of your assistance and co-operation in this very important matter, so the following proposed Special Rule is submitted for your consideration:"

Here followed the proposed Special Rule:

A large majority of the managers in the Province heartily approved the Minister's suggestion, and all, with the exception of two or three who have since complied, were in a position to start the present year under a method of systematic timbering.

The Special Rule, as finally adopted, is uniform throughout the Province, the method of timbering under the rule having been provided for to suit the local conditions of each mine. The rule follows:

Special Rule—Systematic Timbering.

"(a) The manager of the mine shall cause to be posted at a conspicuous place near the mouth of the mine a notice stating the minimum size of the different types of timber to be used in such mine, and the maximum distance between the timbers and between the timbers and the face and sides of the working place.

"(b) In the event of two or more methods of timbering being used in one mine, then, in addition to the notice posted at the mouth of the mine, a notice shall be posted at the entrance to each section or district, stating the method of timbering to be used in such section or district of such mine.

"(c) It shall be the duty of the miner in charge of a working place—which shall include such working place and for a distance of 15 ft. back from the face—to keep the props, timbers or other roof supports erected as designated in the 'Notice of Systematic Timbering' governing the mine, division, or sub-division of such mine in which he is employed.

"(d) Nothing in this section shall prevent a miner from setting supports, or an official from requiring the miner to set supports, in his working place at more frequent intervals than those specified in the notice aforesaid, where necessary for safety.

"(e) Every miner in charge of a working place shall set sufficient sprags or other supports for the

undermined coal, provided that before commencing to mine he shall set one sprag or other support, and not less than one for every six feet of such undermining.

"(f) Temporary props shall only be withdrawn by use of a dog and chain or other type of timber-drawing machine, unless permanent timber has seen set before such withdrawal, and no permanent prop, timber, or other roof support shall be finally withdrawn without the use of such timber-drawing device."

The comment of the Chief Inspector of Mines is: "I believe this is a step in the right direction, and I expect that results during 1914 will fully justify the adoption of this rule."

KIRKLAND LAKE FLOTATIONS.

Mr. T. A. Rickard, in the Mining Magazine, Feb., 1914, says:

The first of these made its appearance early in January with a statement, in lieu of prospectus, couched in terms of studied obscurity. However, it promised a lively gamble and won the support of those on the fringe of the Stock Exchange. The shares have risen since to a big premium, from £1 to 2⅞. On January 15 the report of Mr. H. H. Johnson was published. This deals with the company's chief asset, an option on the Tough-Oakes mine, subsequently the basis for a subsidiary flotation. We have read Mr. Johnson's report with regret. It is a pity that he, as a member of the Institution, should have presented a document so open to criticism. He speaks of 'nuggets' in a vein; that term, of course, being applied only to placer gold. He says a good deal about telluride minerals without making it clear how it affects the value of the mine. It is probable that molybdenite has been mistaken for tellurides, although petzite, altaite and other base metal tellurides do occur. The test for a telluride is so easy that no excuse exists for confusion. In any case, the information as given is conflicting. Apparently the ore—because of the molybdenite—is not docile to amalgamation, for the extraction ranges from 51 to 64 per cent. only. This is compared with the extraction in the Village Deep mill, given as 54.4 per cent., to which 42 per cent. should be added for extraction by cyanidation. The description of the veins themselves is technically incorrect: Mr. Johnson talks about a "dip-strike," meaning probably the 'pitch'; and he says that "the strike in depth is greater than the length of the strike of the paychute (meaning 'ore-shoot') on the surface." Strike should be expressed in terms of the compass; it is a measure of direction. He asserts that "there is every reason to expect the veins to continue in depth, the values at 200 ft. being better than on the surface." There is no reason, unless by "depth" he means 300 ft. He does not discuss the one vital factor, namely, the relations of the veins to the porphyry, except in one obscure and inconclusive paragraph. Finally, as regards the known resources of the property, he finds a reserve of 31,000 tons valued at £220,000. But this estimate evidently did not please the 'management'—presumably the vendors—so he endorses the management's estimate of "over £400,000," explaining that he based his figures on the actual width disclosed in the workings, namely, 5 ft., "whereas the management no doubt takes credit for a width of about 10 ft., and it is only fair to say that recent crosscuts point to at least such a width and probably more being proved, and systematic crosscutting will, in my opinion, hear out the latter figure." Why, then, in the name of Agricola, does Mr. Johnson submit £220,000, or half of "over £400,000," as his estimate? He says he "cannot deviate from the accustomed practice of basing figures on the actual width disclosed by the drifts, etc., to date," but he assumes the average assay of ore in the shaft without having been able to see or sample it himself. He says that the ore 'blocked out' amounts to 12,000 tons averaging 26.9 dwt. "after neglecting the value of the crosscut," but on the next page he assumes an average (34.5 dwt.) that includes the high assay from this very crosscut. On the face of such contradictory statements his opinion of the ore available ceases to have any value in business. Indeed, the information forthcoming concerning the Tough-Oakes and the Kirkland Lake Proprietary is altogether unsatisfactory, and as it comes through a Rhodesian financial agency it must be discounted severely. Some rich ore has been discovered, and healthy prospects exist, but the evidence does not warrant the iridescent expectations expressed by the promoters. As far as the geology is concerned, the veins traverse a schistose conglomerate cut by feldspar porphyry, in the shape of dikes and intercalations.

On January 28 the prospectus of the Kirkland Lake Exploration was advertised. This is worse. The first company had at least secured an option on the richest mine in the district, but the second had only symptoms of indications of doing business. The chances are slight, for the best claims have already been optioned, and only wild-cats on the outside are likely to be available, or inflated schemes with the Kirkland Lake Proprietary, the shares of which are mentioned in the prospectus "as evidence of what is believed to be the value of this new gold-mining area"; as if such quotations afforded a measure of economic value. Nor does the personnel of the board encourage the expectation that "substantial profits" should be earned." It is true one of them is Dr. F. H. Hatch, but he has no special knowledge of mining in Ontario, and the name of the company's resident engineer is withheld. Out of 150,000 shares, 100,000 are optioned to the Anglo-Spanish Trust, with which two of the directors, Colonel Charles H. Villiers and Mr. George Cornwallis West, are connected. These two gentlemen have also taken a call on 5,000 and 20,000 shares, respectively. What is the consideration? Finally, why was Dr. Hatch given a call on 1,500 shares? Was it because his name gave an air of technical verisimilitude to an oblique financial performance? It is true, owing to sundry protests, he has surrendered this call, becoming consulting engineer as well as director, but it remains a thousand pities that the president-elect of the Institution of Mining and Metallurgy should be involved in an affair of this kind. It is nothing more or less than the creation of a counter for unintelligent gambling, only remotely related to the mining with which Dr. Hatch has had an honorable connection. Such blind pools are not adapted to joint stock finance; they should raise their capital privately and defer a public issue until they can furnish evidence that they have something to offer, besides the vague expectations of optimistic promoters.

TO MERGE COBALT PROPERTIES.

London, March 9.—The Daily Mail understands that a scheme is on foot for the amalgamation of some of the leading silver mining companies of the Cobalt field. The scheme includes the Cobalt Town Site Silver Mining Company, Cobalt Lake Mining Company, City of Cobalt Mining Company and the Cobalt property of Town Site Extension Mines. The amalgamated company will have a capital of about $7,500,000.

GAS AND OIL FIELDS OF NEW BRUNSWICK*

By Mathew Lodge.

The existence of gas and oil in the Province of New Brunswick has been known for over sixty years. Possibly the early French settlers on the Peninsula between the Petitcodiac and Memramcook rivers may have lighted the seepages which occurred at various points in that part of the country. Even though they never succeeded in igniting the bubbles that formed on top of the springs, still, the continual disturbance of the waters in many places must have been a source of wonderment to these pioneers. One might allow his imagination to wander into the years prior to the settlement of this part of the country by the white man, and see the Malicite and the Micmac prostrating himself before the fire which he had by some accident lighted and worshipping it as did the men of old in Asia worship the sacred fires of Persia. Or, possibly, our Malicite "brother" was of a more practical turn of mind, and saw in this phenomenon an easier way to cook his bear steak than by gathering wood. And so we can imagine that the hill at Belliveau where one of these large springs still exists was a favorite camping ground.

We do know that the Seneca Indian of New York State were the first to know of the healing qualities of petroleum, which they in a crude way recovered from the springs by placing their blankets on the water and squeezing out the oil so gathered.

The first instance we find recorded of any practical use being made of the gas in the Province of New Brunswick was at Belliveau, the point above-mentioned, where, something like fifty years ago a Mr. Patrick sank several shafts in this district in a search for albertite, and tapped some of the upper gas sands. By placing a pipe into the wall of his shaft at the occurrence, he succeeded in obtaining a sufficient supply of gas to light his offices and workshops. So in the working of the old Albert mines, both oil and gas sands were known to exist, and caused the workmen considerable trouble.

Little value was placed upon these discoveries in what we may now term "the early days," because the value of these products commercially was very little known.

The history of the Albert mines has been so often written, that it is not necessary here to say more than that the Americans knew the value of the albertite and used it in the manufacture of coal oil, wax candles, and also for the enriching of manufactured gas, and until the great discoveries from 1858 to 1865 of liquid oil in Pennsylvania, a large operation was carried on in what was known as the Albert mines, in Albert County, New Brunswick.

Some far-seeing men in the United States and New Brunswick who knew of the oil and gas seepages at various points here recognized the same conditions existing as they found in Pennsylvania, and so as early as 1860, wells were drilled at St. Josephs, Memramcook and Dover on the peninsula before mentioned, and with some degree of success; for in practically all their wells they discovered oil. Their methods, however, were crude; they did not go to any great depth, and so only tapped the upper sands, and obtained only small flows of oil. There is nothing recorded in regard to the gas, but we presume they encountered about the same pressure as that recorded later in the drillings of the New Brunswick Petroleum Company at or near the same point. These early operations were under the direction of a Mr. Merrill, of the Downer Oil Company of Boston and Prof. Carroll; and the financial head of the business was Mr. Louis J. Emery, of Bradford, Penn.

As stated above, the early discoveries of oil were small, and the great oil field that was being opened up in Mr. Emery's own city was too great an attraction for him, and, therefore, he abandoned this field and went into the oil business in his own State, and afterwards built refineries in Bradford and became one of the oil magnates of Pennsylvania. Both Mr. Merrill and Prof. Carroll in after years told the writer that they still had unbounded confidence in the oil possibilities of New Brunswick.

So with a little dabbling here and there, nothing practical was undertaken until the year 1898, when many of the prominent business men of the Province became convinced of the fact that oil and gas in commercial quantities existed here, and acting on their conviction, presented a memorial to the Executive of the Province of New Brunswick inviting them to take under consideration possibilities which they believed existed and to grant them a concession covering a certain portion of the Province, and under conditions of a large expenditure to be made by them in drilling operations; that they the memorialists would undertake to form a company and supply capital to develop the Province.

The then Premier, Hon. H. R. Emmerson, gave the matter his favorable consideration and employed experts to report to him on the possibilities. After receiving these reports, he was so convinced of the soundness of the undertaking that he promoted an Order-in-Council and further legislation to grant these memorialists a portion of the Province to be explored for gas and oil.

The New Brunswick Petroleum Company, Ltd.

On the 16th day of September, 1899, the New Brunswick Petroleum Company, Ltd., secured its charter, but it was not until November, 1901, that the first drilling rig was erected on the farm of Ralph Steeves at Upper Dover. However, in the interim, the company's officers had not been idle. They were fortunate first in securing the co-operation of the Hon. B. F. Pearson, of Halifax, who agreed to help finance the proposition provided he were first satisfied there was a possibility of discovering gas and oil in commercial quantities. To that end, he secured the services of Prof. N. S. Shaler, of Harvard University, to make a thorough geological examination of the territory we controlled, and report.

Prof. Shaler first made personal investigation, and was well satisfied with the conditions found. However, he deemed it advisable to send his staff of engineers under the direction of Harold B. Goodrich, to examine in detail the geological structure of the country, so that Prof. Goodrich, during the summers of 1900 and 1901 with two other engineers, completed a most exhaustive examination of the district under the company's control.

Prof. Shaler personally visited the property many times during this examination, and in 1901 wrote to the N. B. Petroleum Company as follows:

"In view of the facts it appears to me to be an excellent mining venture to prosecute the inquiry under the conditions of your concession from the authorities of the Province. If oil is found, it is likely from the samples shown, to be of excellent quality. It will be near transportation, nearer, indeed, than any other

*From the Journal of Commerce, Montreal, Feb. 14, 1914.

Mr. Mathew Lodge

source of supply to the open sea. The conditions for refining will be excellent, and the market unlimited. You are doubtless aware of the fact that there is a prospect of considerable increase in the price of petroleum. The sources of supply are waning, and no important new fields have been discovered of late.

"The search for petroleum has always to be undertaken with a chance of failure, but I have not seen any field where the general conditions were on the whole more satisfactory than they appear to be here."

"You may say to any of your friends that I am decidedly of the opinion that the field is one eminently fit for exploration, and that the chance for finding oil and gas is extremely good. In fact, I have never seen an unexplored district where the promise is more distinct than in the region in which you are now boring."

You will note that Prof. Shaler was writing in the year 1901. Since that date, many of the great discoveries of oil have been made in parts of Russia, Roumania, Galacia, Persia, the East and West Indies, Mexico, Oklohoma, and much of Texas and California.

In 1903, Prof. Shaler again reported to us, in part, as follows. I only recite one paragraph, as his whole report is too lengthy for this article:

"The evidence already obtained justifies the forecast expressed by me a few years ago that petroleum in commercially important quantities existed in the Province of New Brunswick. The results obtained in no wise diminish my confidence in the discovery of oil and gas at many points in the Province over what will prove to be in the aggregate a very extensive area. Such explorations hereafter may advantageously be carried on elsewhere than at St. Josephs and Weldon and at much greater depth than required for the exploitation of the beds at those points."

You will note that at one point he mentions here, Weldon, we had only at that time bored two shallow holes and made a small discovery of gas and oil. Prof. Shaler told us at that time we must proceed west from these two wells, and put down deep wells into the lower sands where he was confident we would make discoveries of both oil and gas. The N. B. Petroleum Company, however, were unfortunate in having their drilling rigs burned down at this point, and so for the next two years they prosecuted their work on the east side of the Petitcodiac at Dover and St. Josephs, where they secured many small wells of oil from the upper oil sand. And it was not until the Maritime Oilfields, Limited, an English and Scottish syndicate, who took a working option on our property in 1909, and who have since operated it with great success under the direction of Dr. J. A. L. Henderson, an English engineer, carried into effect Prof. Shaler's advice by drilling deeply west of Weldon, that the big gas wells were discovered.

Once more in gas and oil operation was demonstrated the wisdom of working from the known to the unknown; and Dr. Henderson is to be congratulated upon the fact that he has so ably followed this theory.

In 1905 the New Brunswick Petroleum Company, having expended some $250,000 in development work, and having proven that oil and gas existed in commercial quantities, and feeling that they were not financially able to exploit the concession as it should be exploited, sent their officers to England for the purpose of raising large capital.

The Maritime Oilfields, Ltd.

However, during the years 1906, 1907 and 1908 it was practically impossible to raise money for the development of oil and gas fields, so that in January, 1909, our company gave a working option to an English syndicate who came under contract to expend a certain amount of money each year, and to explore our concession. From practically the outset, their success has been phenomenal. Their first large discovery of gas was made at Weldon about two thousand feet west of

Pouring Nitro-Glycerine into the Cylinders to Lower into Well for "Shooting" the Oil Sands

the wells drilled by the N. B. Petroleum Company; and they have been drilling westward and north and south along this line, distributing their wells about two thousand feet apart, and constantly going deeper, and with ever recurring successes of bigger wells than the first, until they have drilled in all, and completed, some forty wells.

The Maritime Oilfields, Ltd., the syndicate above referred to, have developed the field for about 4½ miles westward from their first well, and have proven up about 50,000,000 cu. ft. of gas in the twenty-four hours, some of the wells from the deeper sand having a rock pressure of 550 pounds to the square inch.

The syndicate, realizing that they had struck a big gas pool, confined their energies exclusively to the development of the gas. They have, however, in this district some seven small oil wells, and the writer learned only yesterday that a new oil sand had been struck at a depth of 2,025 ft., which shows great promise.

"We blew the wells in the air for twenty-four hours and made a careful measurement of the output at the end of that time, and find that the open flow production of the field at the present time is 33,186,000 cu. ft. per day."

This report is made on the production of seventeen wells.

Mr. W. P. Craig, the other expert, who is superintendent of the United Natural Gas Co., of Oil City, Penn., reports as follows:

"Referring to the gas field near Moncton, New Brunswick, that Mr. T. O. Sullivan and I inspected, would say that I find the sands that are producing gas in that field resemble the Bradford & Kane sands in the McKean and Elk County, Pennsylvania, fields very much. We found thirteen wells producing gas. We got a test on nine of these wells, which showed an open flow of 31,436,608 cu. ft. of gas daily, after blowing on an average of twenty-four hours. We had to estimate

A View of the New Brunswick Petroleum Company's First Oil Development at Dover, N.B.

Both Professor Shaler and Dr. Henderson had knowledge of this lower sand, and expected from it an extensive new oil area.

It may be well here to give in part the opinions of two of the best-known gas experts in America, on the present developed gas field.

These reports are dated February, 1912, and were made for the T. N. Barnsdall Company, of Pittsburg. The first was made by Mr. T. O. Sullivan, general manager of the Manufacturers' Light & Heat Company, Pittsburg, Pa.:

"The wells after blowing for twenty-four hours, showed but very slight decline in volume; in fact, so little as to be hardly noticeable after the first head was blown off."

"The gas is extremely dry; none of the wells showing water."

"I am enclosing herewith a report showing the rock pressure of the wells, and open flow measurements together with the total output of each well."

"I expect a report from Mr. Craig, Monday, expressing his opinion that this sand very closely resembles the Bradford and Elk County sands of the Pennsylvania field."

the flow of gas on the other four wells, as these wells produce some oil, and they had not been pumped for some time previous to the time we were there, and the gas was partly drowned out. Our estimate of the open flow of these four wells is 1,750,000 cu. ft. This would make a total amount of gas in that field, developed, at the present time, of 33,186,608 cu. ft. There were some other small wells that produced a small quantity of gas and some oil that we made no test or estimate of."

"I see no reason why gas should not extend over a large area in that country, as there has been nothing drilled to condemn the territory south of the Petitcodiac. The drilling done, I think, has been confined to too small an area to make a good test of the country." I would advise branching out south with each location about a mile apart, for several locations so as to test the extent of the territory before contemplating laying any lines to other towns than Moncton, as I would not consider the amount of territory defined at the present time, any more than would supply Moncton with gas, with a reasonable amount held in reserve for future use. As Mr. Sullivan took a map showing the location of the wells, and also a record of each well and a sample of the sand, it will not be necessary for me to explain

these conditions in this report, but I would mention here that from the nature of the gas bearing sands being so nearly like the Bradford and Kane sands for producing gas, I think very well of the Moncton gas territory, and think that development will find gas over a large area."

While Mr. Sullivan in his report speaks of seventeen wells, he is discusing all of the gas and oil wells in the field at that time; but you will note that Mr. Craig is more definite, and gives the production as practically coming all from nine wells. The other wells were smaller, and he did not take them into his calculation. The fact is, as recited before in this article, that the further they went west and the deeper they drilled, the better gas wells were developed.

Having established a desirable quantity of gas, we cannot do better here than submit the report of Dr. J. T. Donald, Official Analyst to the Dominion Government, which reads as follows:

Report of Natural Gas Received from Messrs. Maritime Oilfields, Limited, March 26, 1910.

Montreal, 8th April, 1910.

Specific Gravity	0.686
Weight of 1,000 cu. ft. (lbs.)	55
1,000 cu. ft. of gas produce (large calories).	320,000
1,000 cu. ft. of gas produce (British T. units)	1,280,000

Calorific Value Compared With Coal.

1,000 cu. ft. correspond in heating value to 95 lb. Pittsburg coal (1 lb. Pittsburg coal equal 12,272 B.T.U.)

1,000 cu. ft. correspond in heating value to 85 lb. anthracite. (1 lb. anthracite equals 15,120 B.T.U.)

A natural gas from the Pittsburg district containing approximately:

64 per cent. Methane.
22 per cent. Hydrogen.
5 per cent Ethane.

has a calorific value as follows: 1,000 cu. ft. correspond in heating value to 54.4 lb. Pittsburg coal.

The luminosity of the gas is low, but its efficiency as a fuel very high.

(Signed) J. T. DONALD.

Analysis of New Brunswick Gas.

Oxygen	Trace.
Nitrogen	Trace.
Carbonic Oxide	None.
Carbonic Dioxide	None.
Illuminants	None.
Methane	73 p.c.
Ethane	27 p.c.

(Signed) J. T. DONALD, T.L.C.

As to the cost of gas in actual use in gas engines, the accompanying report of the Dominion Textile Company and its saving in comparison with coal is interesting. Here we have a saving of over 34 per cent. per hour and 39 per cent. on the cost per pound of goods produced.

Comparative Cost of Gas and Coal.

Moncton, N.B.

1911-12.	
Value of coal consumed plus labor	$7,561.02
Loom hours run	8,153.50
Cost per loom hour	.927
1912-13.	
Value of gas used	$7,415.25
Loom hours run	9,662.68
Cost per loom hour	.767
Saving in favor of gas (per loom hour)	.160
17.26 p.c.	

(Signed) J. V. JACKSON.

The satisfaction of the domestic consumer can hardly be expressed in words. The saving over coal to those who have proper appliances for using it is over 25 per cent. In this, we do not include the saving of labor and the cleanliness to the householder. There is another item which will certainly place a long credit of good marks to the average Monctonian (especially of the male sex) in the books of the Recording Angel. With no more ashes to sift, no clinkers to dig out of the furnace, no more exploding stoves from pouring on kerosene, no cold coffee in the mornings, what total abstenance from profanity must characterize our citizens.

The gas was turned on the City of Moncton in March, 1912. The total consumption of gas for the twelve months ending November 30th, 1913, was 819,313,000 cu. ft.

75-foot Gas Flame at Weldon, N.B.

Besides the household and factory use of gas, the Intercolonial Railway charge all their express trains with it, instead of Pintsch gas, so the trains running into Montreal are lighted with Moncton natural gas. The expense to the I.C.R. is only a fraction of what it used to cost them for Pintsch gas.

The capital already invested in this enterprise for the exploration, pipe lines, and other plant, etc., is close on to $1,500,000.

Pipe Lines.

The company have laid down ten miles of 10-inch high pressure gas mains from the wells to the city of Moncton, 5½ miles of 6-inch high pressure pipe line from the wells to the town of Hillsboro, 7¾ miles of

high pressure 4-inch pipe line in the town of Hillsboro, 8¾ miles of low pressure pipe line in the town of Hillsboro, 16½ miles of 6 and 4-in. low pressure pipe line in the city of Moncton and suburbs, and 5½ miles of 6-in. high pressure in Moncton and suburbs.

Number of domestic consumers, 1,812 in the city of Moncton, town of Hillsboro and suburbs of Moncton.

Number of factory consumers, 34 boiler and gas engines.

While natural gas has been an inestimable boon to the citizens of Moncton, it has not thus far attracted the number of manufacturers we at first supposed it would. We have fully established that it is a cheap power, but the Canadian manufacturer has not so far become convinced of the durability of the Canadian gas fields. The writer is informed that in some parts of the Ontario Peninsula the gas deposits have not been of sufficient magnitude to guarantee a steady supply over a period of years. So in New Brunswick, it will possibly be necessary for us to develop and bottle up our wells until we have a guaranteed supply covering a period of many years. Then we can say to the manufacturing world, "Here is cheap power and certain power over a period of time."

The concession granted by the Legislature of New Brunswick to the New Brunswick Petroleum Company, Limited, covers ten thousand square miles of the Province. The selection of this large area was made under the direction of Prof. N. S. Shaler, and we believe we have covered all the gas and oil bearing strata in the Province. The work up to date has only developed a few square miles of this great petroliferous area. Neither the scientist nor the laymen expects or believes that natural gas and oil will be found under all this expanse of country, but we have every reason to think that having the oil and gas-bearing formation throughout our concession, we should at least have as large a percentage of oil and gas "pools" as have been discovered under like conditions and in like formation, both in America and Asia.

This work in New Brunswick has been done from the beginning along conservative lines. The doubting "Thomas's" in our own Province did all they could to discourage the project, and some of them took particular pains to advertise the scheme as one of the most chimerical. It did not matter to them that they had not contributed, and that the company carrying on the development were not asking the public to contribute; they simply could not allow this opportunity to pass to hit New Brunswick on the head. I fear that in the past the enemies of this magnificent Province have been more within than without, in-so-far as advertising our splendid possibilities has been concerned. We are glad to state that this order of things is gradually passing and our own people are waking up to the opportunities they have been falling over for so many years.

MANGANESE-STEEL RAILS.*

By Sir Robert Hadfield.

In a paper on Iron Alloys, with Special Reference to Manganese Steel, read before this Institute at the International Engineering Congress in Chicago in 1893, the writer mentioned that, about 20 years ago, his firm in Sheffield produced railroad material, such as tires and axles, of forged and rolled manganese steel, thus showing that this product could be manipulated and worked up into the various required forms. The tires illustrated in the paper referred to above formed a particularly difficult class of work to produce in a special steel, but no special obstacles were met with. Although there was no difficulty at that time in making and producing manganese steel in various forms, forged, rolled or pressed; nevertheless, on account of its higher expense, sufficient encouragement was not then obtained from the users to introduce these products on a large scale. There never has been any real difficulty in obtaining forged, rolled, or pressed manganese steel, provided the consumer was willing to pay the necessarily higher cost as compared with ordinary steel.

The matter was further pursued in the present decade: In 1904, a French manufacturer produced rolled manganese-steel rails of 7½ kg. per meter.

Tests on these rails were so satisfactory that manganese-steel rails of heavy section, 100 lb. per yd., varying from 6 to 12 m. in length, were then produced in the same rolling mill.

A large number of these rails were rolled in 1907, and were supplied to the Metropolitan Electric Railway of Paris, and put to work, among other places, at the Bastile station in that city. These rails, after several years of service on severe curve work, have given great satisfaction. After three years' hard service, the actual wear was found to be not more than about 2½ mm. It has been estimated that the rails will remain in service for six to seven years before being worn out, whereas ordinary steel rails wear out and have to be replaced in less than a year.

A plant for producing sound ingots under the system devised by the writer was described in a paper presented to the Institute at the February, 1913, meeting. No less than 90 per cent. of sound material is obtained from an alloy steel, which will therefore be seen to offer great advantages. Each 1 per cent. of expensive material saved means that much reduction in the cost of production. The consumer has now to pay for 15, 20, or even 30 per cent. of waste in special steels made in the ordinary way, whereas this waste can to a large extent be avoided. Moreover, better and more uniform quality of alloy steel can be obtained.

*Extracts from a paper presented at New York Meeting, A. I. M. E., February, 1914.

INTERCOLONIAL COAL CO.

The coal and coke output of the Intercolonial Co. last year was the smallest since 1899, and 37,267 smaller than that of 1912.

The company, as recently reorganized, held its annual meeting last week, but pursuing the policy of many years, no figures were made public beyond the year's output.

The output has been falling off for years as the result of the increased cost of production, and as a consequence the company has been losing money.

The output of coal and coke for the year ending 31st December, 1913, amounted to 198,590 tons, compared with 235,857 tons in 1912.—Journal of Commerce.

DOMINION STEEL.

The dividend on Dominion Steel has been passed. The directors of the company met on Wednesday, March 4, and after a lengthy session decided to pass the dividend on the common stock.

At the close of the meeting they gave out the following statement:

"In view of the depression in general trade conditions, and in the steel trade in particular, it is considered advisable to confine the dividend on the common stock of the corporation to the three per cent. already paid, and not to pay the usual dividend on the 1st April."

The suspension of dividends on the common stock will mean a saving of about $1,225,000 a year; eleven quarterly distributions aggregating about $3,370,000 have been paid on the common stock since dividends were inaugurated in July, 1911.

THE MILL AND METALLURGICAL PRACTICE OF THE NIPISSING MINING COMPANY, LIMITED*

By James Johnston, Cobalt, Ont.

Upon the completion and successful operation of a mill to treat high grade silver ores the Nipissing Mining Company, under the general management of Mr. R. B. Watson, commenced a series of investigations having as their object the possible successful treatment of low grade Cobalt silver ores by the cyanide process, with a view to the marketing of silver bullion only. Experimental tests were made on a large scale, in July, 1911, by Mr. G. H. Clevenger, who used for his experimentation an average mixture of Nipissing ores: a partial amalgamation followed by cyanide treatment gave an extraction ranging from 90 per cent. to 93 per cent. and this test was so encouraging as to warrant Mr. Charles Butters, the company's consulting metallurgist, in recommending that the new low grade ore mill then under contemplation should be a cyanide, instead of a concentrating, mill. The cost of a cyanide mill with a capacity to treat 200 tons per day was estimated at about $250,000, and it was also estimated that with such a mill it would be possible to obtain a 90 per cent. extraction at a working cost of $3 per ton of ore treated.

This decision respecting the type of mill and process was arrived at after comparing concentration, which involved the shipment of concentrates to a smelter, with cyanidation, which produced metallic silver bullion, 999 fine, as the final product.

The following table shows the comparisons made:

Comparison of Mills Treating 200 Tons per Day.

Assay of ore 30.99 oz. commercial
1.10 oz. correction on pulp

32.09 oz. corrected assay

Concentration mill to give an 80 per cent. extraction. Approximate cost $160,000.00.		
80 per cent. x 32.09 oz.=25.67 oz. at 52c.=		$13.35
Working costs	$1.25	
Marketing concentrates 10 per cent.	1.33	
Difference between corrected and commercial assay on concentrates= 2 per cent.	0.27	2.85
Profits per ton		$10.50

Cyanide mill to give a 90 per cent. extraction. Approximate cost $250,000.00.		
90 per cent. x 32.09 oz.=28.88 at 52 c. plus 3-10 c. increase price in marketing=		$15.16
Working cost=	$3.00	
Express on bullion, $3.50 per cwt.=23c. per oz. on 28.88 oz.=	0.07	3.07
Profits per ton		$12.09

Profits per ton from cyanide mill $12.09
Profits per ton from concentration mill 10.50

Profits in favor of cyanide mill ..... $1.59 per ton ore treated.

Thus it will be seen that a cyanide mill, after having treated 56,600 tons (283 days' run), would have reimbursed the company for the extra $90,000.00 required for its construction, provided it were possible to obtain the above results.

The results that are now being obtained in the cyanide mill are as follows:

Cost of construction	$254,839.52
Working costs less than	$3.00 per ton
Extraction on 26 oz. ore	92% to 93%
Tonnage treated per day	244

The above figures prove conclusively that the results obtained in the preliminary experiments have been more than borne out in actual practice, thus fully justifying the adoption of this type of treatment.

The cyanide mill has an additional advantage over the concentrator in that it is able to get an extraction of over 90 per cent. on the arsenic-antimony-silver combinations and on the decomposed silver minerals found in some veins, on which concentrators can make only a poor saving.

During the construction of the mill experimental work was continued with a view to simplifying and bettering the process as it was then known, and also to more fully determine methods for overcoming the difficulties that others had experienced in their unsuccessful attempts to make such ores amenable to an all-cyanide treatment. Some of the results obtained during this time have been ably recorded by Mr. J. J. Denny in an article on "Desulphurizing Silver Ores at Cobalt," published in the Mining and Scientific Press, under date of September 27th, 1913; and in an article on "Aluminum Dust Precipitation" in the issue of the Engineering and Mining Journal of May 10th, 1913, Mr. E. M. Hamilton fully records the difficulties experienced elsewhere by the fouling of the cyanide solution where zinc dust is used as a precipitant and the conclusion which led to the adoption of aluminum dust as the precipitant in this mill.

A mill, with a proposed capacity of 200 tons per day was designed by Mr. Butters and the writer. Provision was made in the plan so that any change could be made during construction, should the results of the further experimental work which Mr. Butters had suggested indicate that everything could be treated by an all-cyanide process. The experience gained from these tests resulted in modifications of the plans and flow sheet before erection was completed, to enable aluminum dust precipitation and the desulphurizing process to be introduced.

A synopisis of the mill process is as follows:

Crushing the ore to 3 in. in gyratory crushers before sending it to the washing plant.

Hand picking and jigging of the high grade ore in the washing plant, the product from which is then sent to the high grade ore mill.

Crushing the discards from the washing plant (known as low grade ore) to 1½ in. mesh and sending them to the battery.

*Extracts from paper presented at Annual Meeting, C. M. I., Montreal, March 4, 1914.

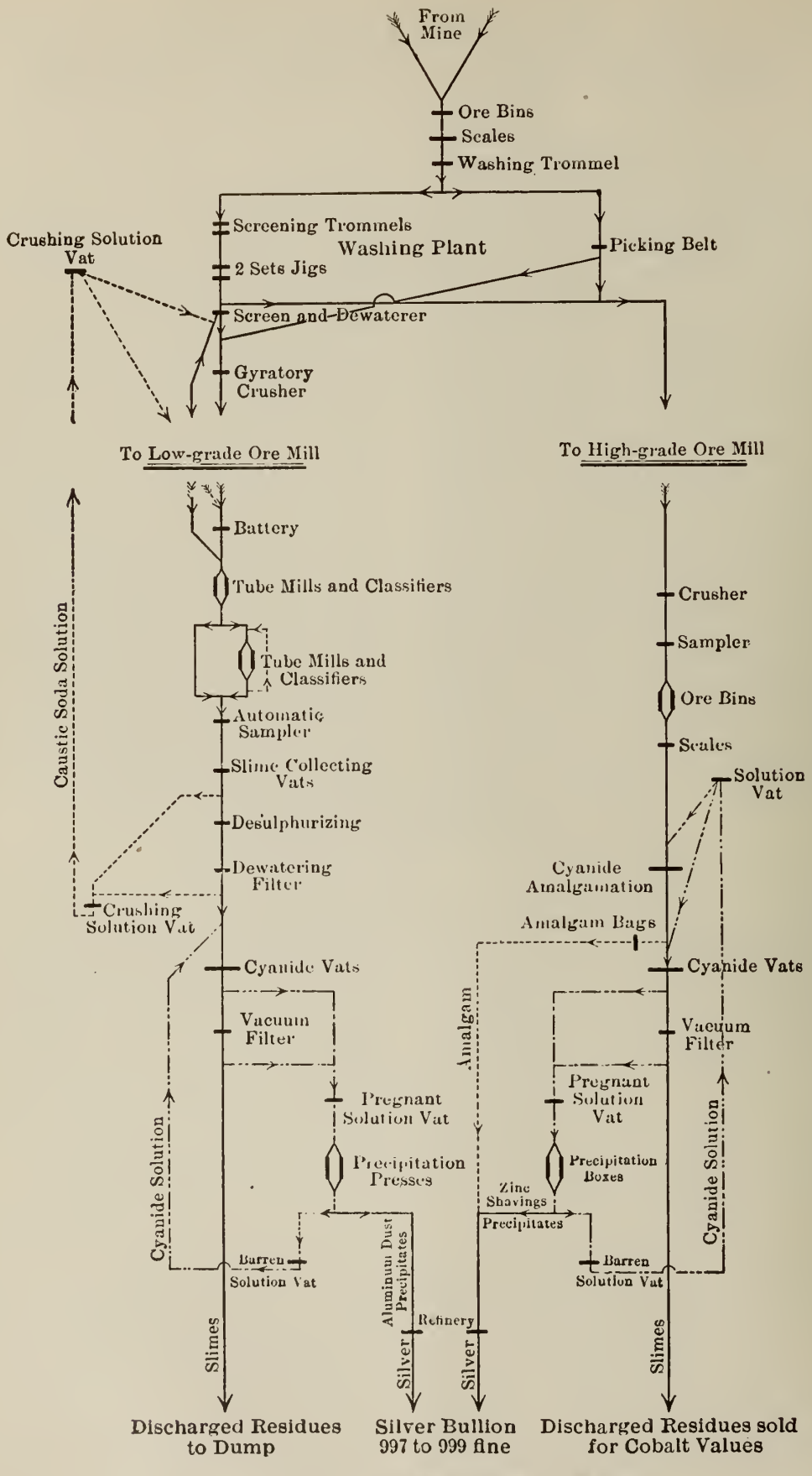


Fig. 1—Flow Sheet of Nipissing Mining Co.'s Mills

Crushing the low grade ore in the battery and in tube mills in a caustic soda solution, forming an all-slime product.

Collecting the slimes and desulphurizing them in tube mill and tanks.

Dewatering the slimes and transferring them to tanks for cyanide treatment.

Filtering the slimes and discharging them to waste dump. Precipitation of the cyanide solution, coming from the slime treatment tanks and the filter, by alum-

inum dust. The aluminum dust precipitate is taken to the refinery and there melted and refined to silver bullion of 997-999 fineness. The details are on the flow sheet and plans.

Construction.

The mill site is practically on the highest point of the Nipissing Hill and is so located that easy tram line communication can be made between any point on the company's property and the mill; it also allows ample dump capacity below the mill for residues.

Excavations.—These were started in November, 1911, and the following data show the cost for soil and rock work. The figures given are fair averages, other parts of the same class of work on other levels costing a little more or less.

Cost of Excavations.

Soil work on tank floor level containing 2,404 cu. yd.

Labor	$1,369.00
Sundry supplies	59.76
Teaming	6.03
Blacksmith's shop	17.60
	$1,452.39=$0.604 per cu. yd.

Rock work on same floor, containing 3,144 cu. yd.

Labor	$5,539.00
Sundry supplies	123.52
Explosives	279.41
Blacksmith's shop	102.75
Air drills	1,196.32
Hauling rock to dump	1,503.68
Lumber	25.50
	$8,770.18= $2.79 per cu. yd.

Concrete Foundations.—The walls for buildings and machinery foundations are of concrete. The crushing and mixing plant for concrete making was placed on a level above the uppermost floor, from which the material was transferred by chutes and cars into the various foundation forms, the necessary machinery being driven by compressed air. A mixture of 1 of cement, 3 of sand, and 5 of stone (together with the addition of all the large stone the concrete would hold as it lay in place in the forms), was used throughout the foundations, with the exception of the battery, tube mill, and other machinery foundations which were to be subjected to much vibration. In these cases the upper one or two feet of the foundation were strengthened by the addition of cement.

The following are representative costs:

Cost of Foundations and Walls.

Battery foundation and walls, for the building and ore bins,

Battery block =	848 cu. yds. concrete
Building and walls =	349 cu. yds. concrete
Total	1195 cu. yds.; used 945 bbls. cement
Labor	$2,669.48
Supplies	3,735.33
Lumber	246.57
Carpenter shop labor	790.86
Machine shop labor	87.78
Teaming	139.34
Fuel	12.85
Air for operating machinery	400.00
	$8,082.21=$6.76 per cu. yd.

Retaining walls and sundry small walls and foundation on tank floor lead:

434 cu. yd. used 485 barrels cement.

Labor	$1,645.57
Supplies	2,152.52
Lumber	337.76
Carpenter shop labor	1,180.05
Machine shop labor	26.09
Teaming	26.33
Fuel	12.85
Air for operating machinery	300.00
	$5,681.17=$13.09 per cu. yd.

Cement was shipped to the mill in bags of which four were equivalent to one barrel, the total consumption being 3,355 barrels at an average cost of $2.06 per barrel. Only 65% of the empty bags were fit to be returned to the cement company, the balance having been destroyed in shipment and handling.

The various forms for concrete foundations, etc., around the mill made use of 26,339 ft. b.m. of 1″ boarding and 20,771 ft. b.m. of other sizes of lumber, part of which, when taken down, was used for other purposes.

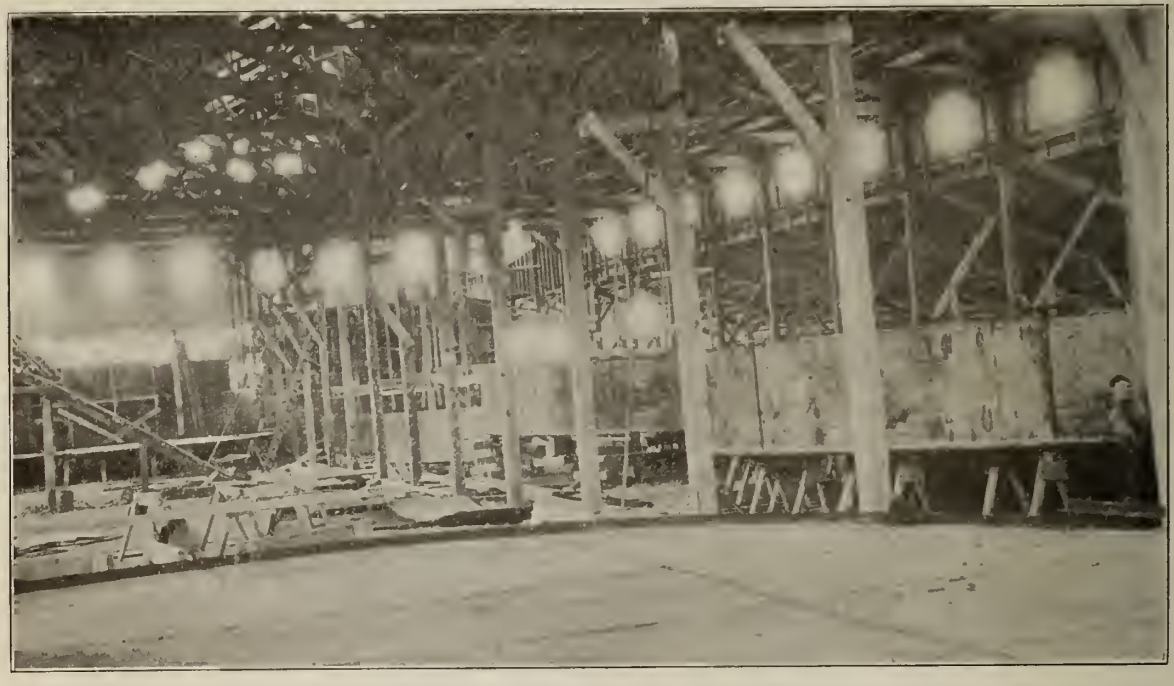
The mill building is constructed with wood framing covered with 1″ boarding, building paper and corrugated iron, so as to make a warm building for winter service. There were used 398,601 ft. b.m. lumber in its construction; of this 148,250 ft. b.m. was 1″ boarding. The total quantity of lumber employed in the whole of the construction was 1,199,206 ft. b.m., the value of which was $23,731.33.

Cost of Construction of the Low Grade Ore Mill (Crushing and Cyanide Section).

The following statements cover the complete cost of the construction of the mill. These accounts were closed about three months after the mill went into operation, so that all the adjustments made necessary after the starting of the mill, in which some new departures in metallurgy were being exploited, are included in these total costs.

The original estimated cost of this section of the mill as enumerated in the following list of departments was made in October, 1911, and totalled $250,000.00.

Departments.	Cost to Jan. 31st, 1913
Store and office building	$725.65
Proportion office and supervision during construction	6,652.97
Excavations	29,728.30
Foundations	20,159.39
Buildings over mill	24,618.99
Battery equipment	24,241.42
Battery equipment proportion electrical equipment	5,267.38
Tube mills and classifiers	23,223.80
Tube mills proportion electrical equipment	12,091.02
Slime treatment and storages	31,519.84
Slime treatment proportion electrical equipment	4,477.26
Cyanide filter plant	14,154.92
Cyanide filter, proportion electrical equipment	3,040.71
Piping, pumps, etc.	12,886.19
Precipitation	9,989.23
Precipitation, proportion electrical equipment	239.42
Heating plant	12,333.70
Water service	5,288.57
Water service, proportion electrical equipment	1,028.13
	$241,666.89
To this cost was added later the installation of the intermediate filtering and desulphurizing equipment, not included in original estimate	13,172.63
Total cost of mill	$254,839.52



A View of Nipissing Cyanide Plant During Construction

Other mill construction work undertaken at the same time and which would have been common, either to a cyanide mill or a concentrator, is as follows:

Tram Lines, Washing Plant, Etc. Section.

Departments.	Cost to Jan. 31st, 1913
Crushing, sorting and jigging	$25,836.64
Crushing proportion electrical equipment	2,274.55
Meyer crushing section	5,945.98
Tramlines aerial	18,299.05
Tramlines Kendall	6,499.61
Fixing roads	4,386.02
Workshops	4,813.14
Proportion office and supervision during construction	1,756.26
Total cost	$69,811.25

Ore Delivery.

All the ore from the various workings, after it has been crushed to 3″ cubes in gyratory crushers, is delivered into the ore bins of the washing plant. The ore from the northwest side of Cobalt Lake is conveyed to the plant by a Bleichert aerial tramway 3,560 ft. long having a rise from the loading to the unloading station of 172 ft.; the longest span is 1,080 ft. which is the distance across Cobalt Lake. The buckets travel at the rate of 500 ft. per minute and the tramline delivers 110 buckets of 6 cu. ft. capacity each, equivalent to about 35 tons per hour, and requiring 10 h.p. to operate the line. The ore from the workings of the property situated on the mill side of Cobalt Lake is delivered to the mill by surface tramlines.

Washing Plant.

The ore bins, of which there are four, each of 80 tons capacity, are so arranged that one class, or several classes, of ore may be sent to be milled as conditions require. The ore from the bins is loaded into a 20 cu. ft. car and passed over a Fairbanks registering scale which makes a record of the total weight of ore delivered to the mill. The ore is then fed through a long washing trommel, 40″ in diameter and 10 ft. in length, which makes 14 revolutions per minute; the screen portion of this trommel is perforated with holes 1½″ in diameter. The oversize, or coarse ore, from the screen falls on a picking belt 30″ wide from which the hand picked portion of the high grade ore is sorted, the low grade portion being conveyed by the belt and delivered to a crusher by which it is broken to 1½″ mesh before passing into the battery ore bins. The undersize, or ore which falls through the perforations of the first trommel, goes to a washing trommel, 30″ in diameter and 6 ft. long, which makes 20 revolutions per minute; this washing trommel has a screen with ½″ round holes, the over size of which goes to two jigs which are fitted with rolled slot wire cloth screens, the width of the slots being 0.115″. From this screen the first portion going to the jigs is collected. The undersize from this last trommel is conveyed to another trommel, 36″ in diameter and 9 ft. long, which makes 20 revolutions per minute; the screen has round holes of 3 millimeters in diameter and the discards, or oversize, from this last screen go to two other jigs which also are fitted with rolled slot wire cloth screens, the width of the slot here being 0.040″; and at this point the second jig portion of the high grade ore is obtained.

The undersize from this last trommel, together with the discards from the four jigs is elevated to a dewatered trommel, which is 30″ in diameter and 6 ft. long and which has a wire cloth screen with 3 meshes to the inch. From this dewatered trommel the oversize joins that portion of the ore, coming from the picking belt, which is destined for the battery bins, while the undersize is sent direct to join the pulp from the battery before it goes into the tube mills. This portion of the ore, amounting to about 10% to 15%, represents the original fines as they come from the mine and also the fines which may have been produced in the preliminary stages of crushing. The bi-passing of these fines around the stamp batteries has very successfully and materially assisted the battery work.

Construction of One of the Vats, Nipissing Cyanide Plant

The water used in the washing plant is continually circulated by a centrifugal slime pump 4″ in diameter. A few pounds of lime are added to the water daily to assist the settlement of slimes, which are collected in two tanks, each of which is 12 feet in height and whence, after settlement, the slimes flow to the tube mill pulp storage tanks. The power required to operate this plant for 9 hours is 35 k.w. during which time from 300 to 350 tons are handled.

This part of the practice followed very successfully the lines of previous sorting and jigging which had been worked out by the company, and it owes much of its success to Mr. H. A. Kee and his experience in this class of work.

The high grade ore which is sorted out in this part of

Nipissing Low-Grade Plant

Nipissing High-Grade Plant

the mill varies considerably in grade and in quantity, but the average figure taken on the basis of each 100 tons treated is as follows:

Hand picked ore	0.662 tons	Aver. value 2803 oz. per ton
First jigs	0.265 tons	Aver. value 2496 oz. per ton
Second jigs ...	0.138 tons	Aver. value 2200 oz. per ton
	1.065 tons	2648.47 oz.

This ore is then sent to the high grade ore mill where it is treated by the cyanide amalgamation process described in Mr. R. B. Watson's article (Engineering & Mining Journal, Dec. 7th, 1912), a recovery of 97% being obtained by amalgamation, and a further 2% by cyaniding, or a total recovery of 99% from ore carrying 2,648.47 oz. silver per ton. The residues, which contain from 8% to 9% of cobalt, are afterwards sold for the value of the cobalt, and 85% of the silver contents, so that from an ore of the above original head value, there are about 4 oz. only of the silver values not paid for.

The ore after being crushed to 1½" in a No. 4 gyratory crusher is transferred on a 20" belt conveyor into the mill building; then elevated by a 16" bucket elevator into the battery ore bin, which has a capacity of 780 tons.

The feeders are of the suspended Nelson type.

(To be continued.)

GOWGANDA APEX.

The Financial Times of Montreal says:

Members of the Gowganda Apex Underwriters Syndicate are being asked by Messrs. Day, Ferguson & O'Sullivan, solicitors of Toronto, to surrender their memberships in exchange for a corresponding block of stock in the Silver Mines of Canada, Ltd.—each member getting the same number of shares as he was to have received in the Gowganda Apex Co. The offer is on behalf of Mr. Dowling, the original holder of both groups of properties. The letter says in part:

"Like all the companies and syndicates seeking for money to develop Gowganda properties, the syndicate was a financial failure, and there were not enough memberships sold to pay for the advertising and expenses. However, Mr. Dowling, who was the original purchaser of the properties, and had consented to turn his options into a syndicate and allow the proceeds of sales of interests to be used in the development of the property, felt that by reason of other persons having become interested, he should continue the development work, and he personally put up the money required to complete the purchase and to do the necessary assessment work. He owns about ninety per cent. of the entire syndicate memberships. The result of the development work was unsatisfactory, and there was not sufficient silver found to justify a person spending more money on the properties.

"The Silver Mines of Canada, Ltd., is a company owning a large number of claims in the Gowganda mining camp, which claims are at Bloom Lake, and include the well-known Donaldson mines, on which extensive development has been done. The company has some eighteen claims and has carried on extensive and costly development work for some years, and now about fourteen claims are ready for patent. He has proposed to this company to turn over to it the old claims of the Apex Syndicate if the directors feel like putting up the money to take out patents, and he has instructed us, out of the stock owned by him in Silver Mines of Canada, Ltd., to issue to each of the members of the Gowganda Apex Syndicate the same number of fully paid-up shares as they would have got had the Gowganda Apex Company been formed.

"Native silver has been found in seven different veins on the surface of these properties, while about 20 other veins assay silver. One shaft is now being sunk to the 100 ft. level, when driftings in different directions will probably be made. Another shaft is down 30 ft., and on different parts of the properties there are eight or ten test pits of varying depths, some 15 ft. deep, and some of these show silver. Hitherto it has cost as much as $40 a ton to freight supplies and machinery to the property, and under these conditions, development work has been impossible, but the near approach of the Government railway, and the general improvement in mining conditions in the locality gives a much better outlook to the company."

HILLCREST COLLIERIES, LTD.

Net profits of the Hillcrest Collieries, Ltd., in 1913, according to the statement presented at the annual meeting of shareholders this week, showed an increase of approximately 25 per cent., while surplus after all charges and preferred dividend fell just a little short of making a 100 per cent. increase.

With rentals of buildings and other revenue added to net profits from operation after providing for all expenses and depreciation, the company last year had a net revenue of $133,823. After deducting bond and other interest and preferred stock dividend, the balance remaining as surplus for the year was $61,601, equal to 6.16 per cent. on the $1,000,000 common stock, against $32,660, or 3.26 per cent. on the common stock in 1912.

PERSONAL AND GENERAL

Mr. Frank Loring is in England.

Mr. R. B. Lamb has left Toronto on a trip to England.

Mr. R. W. Brock, Dominion Deputy Minister of Mines, has been on a short holiday trip to Bermuda.

Mr. G. G. Gibbins has returned from Vancouver and is examining properties in Eastern Ontario.

Mr. J. B. Cooper, superintendent of the Calumet and Hecla Mining Co.'s smelters at Hubbel, Mich., died on Friday, Feb. 27, 1914.

Mr. F. R. Wolfle, of Spokane, Washington, manager of the Florence Mining Co., was at the company's mine in Ainsworth mining division, B.C., last month.

Dr. F. H. Hatch was invited to attend the annual meeting of the Canadian Mining Institute, but was unable to do so owing to his hurried return to London.

Mr. K. B. Carruthers, superintendent of the Consolidated Mining and Smelting Co.'s Molly Gibson silver-lead mine, in Nelson mining division, has returned to British Columbia from a trip East.

Mr. A. A. Cole, Cobalt, has been elected a vice-president of the Canadian Mining Institute to fill the vacancy caused by Mr. G. G. S. Lindsey's election to the presidency.

Prof. Milnor Roberts, dean of the College of Mining, University of Washington, Seattle, Washington, went to Vancouver last month to attend the meeting of the Western Branch of the Canadian Mining Institute.

Mr. A. W. Davis, of the Consolidated Mining and Smelting Co.'s mining engineering staff, left Kootenay district, British Columbia, about the middle of February on a vacation which he planned to spend in Eastern Canada.

Mr. J. W. Boyle, general manager of the Canadian Klondike Mining Co., was at Woodstock last month, his mother having recently died there. He will return to the Yukon in time for the coming season's placer-gold mining operations in that part of Canada.

Mr. O. B. Smith, superintendent of mines for the Granby Consolidated Co., last month went from Granby bay to the company's Mamie mine, near Hadley, Prince of Wales island, Southeast Alaska, before returning to his headquarters in Vancouver, B.C.

Dr. F. H. Hatch, president-elect of the Institution of Mining and Metallurgy, London, and consulting engineer for the Kirkland Lake Exploration Co., spent ten days at the Tough-Oakes mine, Kirkland Lake, and has returned to London.

Mr. E. H. Williams, for seven years assayer at the 40 stamp mill at Hedley, Similkameen, B.C., has been stricken with blindness. Several months ago he went to England for expert treatment, but his journey was of no avail, for a recent advice received at Hedley stated that he had quite lost his sight.

Mr. Thos. McGuckie, formerly general superintendent for the Western Fuel Co., Nanaimo, B.C., has received from the headquarters in England of the St. John Ambulance Association, a communication expressing appreciation of the effective and valuable work he has done in furthering first-aid work among miners who were employed in coal mines in the neighborhood of Nanaimo.

Mr. Thos. Russell, for years mine manager for the New Vancouver Coal and Land Co., operating the collieries in Nanaimo district, Vancouver island, British Columbia, now owned by the Western Fuel Co., and afterward superintendent of the Extension colliery of the Canadian Collieries (Dunsmuir), Ltd., was lately appointed superintendent of the Crow's Nest Pass Coal Co.'s Michel colliery in Southeast Kootenay, B.C.

Mr. J. Street, of Whitewater, B.C., mine superintendent for the John L. Retallack & Co. mining syndicate, was in Kaslo in the latter part of February, expecting to have to spend several weeks in the local hospital.

The H. W. Johns-Manville Co. announce that the necessity for larger space and better facilities to handle their increased business, compelled the Indianapolis, Ind., and Louisville, Ky., branches to seek larger quarters. The new address of the Indianapolis branch is 408-410 North Capitol Ave., that of the Louisville branch, 659-661 South Fourth Ave.

Canadian Allis-Chalmers, Ltd., Toronto, have been appointed exclusive agents for Canada and Newfoundland of the Avery automatic scales. The parent factory at Birmington, England, was established almost 200 years ago, and is without doubt the oldest and largest scale company in the world, comprising factories in England employing 5,000, and another at North Milwaukee, Wis.

Rock and Power Machinery, Ltd., has been awarded contracts by the Point Anne Quarries for a special Kennedy revolving screen, by the Ontario Stone Corporation for a No. 6 Kennedy crusher elevator, screens, etc., by the Gravenhurst Crushed Granite Co. for a complete rock crushing plant, including two No. 6 and one No. 8 Kennedy gyratory crushers, and a 75 ft. Kennedy elevator; also rock drills and F J A B steel.

COBALT SHIPMENTS.

(Cobalt Nugget.)

The shipments from the Cobalt mines for the week ending March 6th were, in pounds:

	High.	Low.	Total.
Hudson Bay	148,350		148,350
Dom. Red		176,400	176,400
Seneca-Superior	61,300		61,300
Penn-Canadian		40,000	40,000
Crown Reserve	40,000		40,000
Coniagas	168,760		168,750
Cobalt Townsite	71,890		71,890
Trethewey	44,230	40,400	84,630
La Rose	86,910		86,910
	621,430	256,800	878,230

The bullion record for the week ending March 6th is:

	Bars.	Oz.	Value.
Nipissing	80	96,206.63	$65,318.81
Buffalo	43	44,424.35	26,000.00
Kerr Lake	17	14,737.00	7,015.52
O'Brien	10	9,138.00	5,254.57
	150	164,505.98	$103,588.90

The bullion shipments for the year to date are:

	Oz.	Value.
Nipissing	1,082,546.81	$633,137.67
Dom. Red	149,292.00	87,777.24
Buffalo	188,450.35	109,500.00
Crown Reserve	94,024.00	54,323.25
O'Brien	46,274.30	26,195.46
Kerr Lake	33,313.75	16,909.74
Foster Ls. Co.	2,187.25	1,141.44
Penn. Can.	3,416.50	1,771.52
Casey Cobalt	2,893.00	1,484.00
	1,602,397.96	$932,240.32

SPECIAL CORRESPONDENCE

KIRKLAND LAKE, SWASTIKA AND PORCUPINE

Payments Made on Properties.

On behalf of the Kirkland Lake Proprietary first payments have now been made on both the Burnside and the Teck-Hughes at Kirkland Lake. Substantial payments had already been made on the Tough-Oakes.

Of much importance to the camp was the visit of Dr. F. H. Hatch, president-elect of the Institution of Mining and Metallurgy. Dr. Hatch arrived in Swastika on February 23rd and stayed for ten days at the Tough-Oakes mine. He inspected all the more prominent mines and prospects before he returned south. Dr. Hatch is consulting engineer for the Kirkland Lake Exploration Company, an English syndicate holding some claims in the new gold camp.

At the Tough-Oakes gold mine development in the shaft below the 200 ft. level and in the No. 3 shaft is showing up extremely well.

Teck-Hughes.—The ore body struck on the Teck-Hughes appears to be quite promising. It was found in a crosscut on the 75 ft. level, 70 ft. from the drift on the No. 3 vein. The new vein consists of about four or five in. of high grade ore. For about two ft. on either side of the vein the rock will probably make milling ore. Two ore shoots on the No. 3 vein were quite high grade.

Dome.—At the Dome the No. 2 shaft is being sunk from the fifth to the seventh level, giving a depth of 575 ft. The work, which has been commenced from the 425 ft. level, should be completed in three months' time. At the 425 ft. level much ore has been opened up, but upper levels have not been much developed yet. But by the time the shaft is sunk to the new low level the fifth level will be in good shape for stoping for the mill.

It is not expected that the addition to the mill will be running before the middle of April. The February output from the Dome will show a falling off owing to the temporary break down of the power available.

Hollinger.—The gross profits from the Hollinger mine for the four weekly period ending Jan. 28 showed $101,663, as compared with $114,249 in the previous period. The surplus now stands at $700,126. Over 1,000 ft. of diamond drilling located two new ore bodies. These new ore bodies were on the 425 ft. levels and 200 ft. levels respectively. General development amounted to 817 ft. The mill ran 96 per cent. of possible running time, treating 12,813 tons, of which 256 tons were treated for the Acme gold mines. The average value of Hollinger ore treated was $13.75 per ton, approximate extraction 96.33 per cent.

McIntyre.—The McIntyre Company is now driving a lengthy crosscut from the 600 ft. level of the Pearl Lake mine. Arrangements have been completed whereby in return for work to be done underground the McIntyre has the use of the workings of the Pearl Lake. About 300 ft. of crosscutting has been completed, and another 800 ft. will connect with the shafts of the McIntyre south of the lake. Thirty ft. of quartz and mineralized schist has recently been cut in the working near the contact between the porphyry and the basalt. The values are stated to be about $8 a ton. From the 600 ft. level 200 ft. of drifting has been done on No. 5 vein. No. 5 vein on the McIntyre at the 600 ft. level shows 8 ft. of ore. The vein at No. 4 shaft has been opened up for 110 ft., and in the face shows six and a half ft. of $18.00 ore.

Dome Lake.—Some remarkable samples have been taken from the ore body on the Dome Lake mine at Porcupine at the 115 ft. level, about 180 ft. from the main shaft. While the vein is narrow, it shows very rich in gold. The vein matter also is heavy in sulphides. This is believed to be a new ore body.

COBALT, GOWGANDA, AND SOUTH LORRAIN

Cobalt Lake.—The annual report of the Cobalt Lake Mining Co. shows a falling off in net returns from ore and a substantial increase in ore reserves. This increase is obtained, as President Sir Henry Pellatt explains, by the fact that now the ore under the lake will be available, since the authorities have permitted the draining of the lake. On Dec. 31, 1912, the profit and loss account showed a credit balance of $425,947, this year the credit balance amounts to $407,460. The cash on deposit was $60,143, and the amount due from smelters at the last of the year was estimated at $109 795. Ore reserves are shown by the engineer's report as 4,796,940 oz, which is an increase of 2,661,900 oz. over the statement of last year. Dividends aggregating ten and one-half per cent., or $315,000, have been paid during the year. The net returns from ore for the year show a decrease of $77,628. This was owing to the fact that extensive improvements have been made at the mine, necessitating the milling of ore entirely from the dumps for a period of two months. The general statement at the mine reads:

Silver in ore shipped to smelter	973,676.09 oz.
Allowed on smelter contract	49,497.70 oz.
Total silver paid for	924,178.39 oz.
Estimated value of silver recovered at mine.	$570,574.18
Cost of producing	248,819.58
Profit at mine	$321,754.60
Estimated cost of marketing silver	52,303.86
Estimated profit at smelter	$269,450.74

In relation to the method by which Mr. Gordon estimates his ore reserves, it is interesting to note that he says:

"On Dec. 23rd, 1913, Mr. T. E. Godson, the Mining Commissioner, made the award in the Cobalt Lake draining question granting the company permission to drain the lake. This work will be commenced as soon as the final agreements between the different companies concerned and ourselves are completed, namely, those companies that have property adjacent to the lake or that draw water therefrom. The order so granted will allow us upon the completion of the draining to recover the ore that now lies in what was called our safety wall, which is a partition of 40 ft. and upwards between our underground workings and the rock bottom of the lake, and I have therefore included this partition in my estimates of ore reserve this year, which in past years I omitted."

Mr. M. B. R. Gordon places ore reserves at 169,601 tons, containing 4,796,940 oz. Of this amount 6,496

tons, containing 129,920 oz., is ore broken in stopes.

As to milling, it is stated that the extraction has been raised to 81.3 per cent., as against 79.3 per cent. for 1912. During the present year it is proposed to increase the tonnage treated, bringing it up 175 tons or over per day. This will make possible the treatment of lower grades of ore.

Timiskaming.—Owing to the fact that there has been a very brisk fight for the control of the Timiskaming Mining Co., the annual report just published is of especial interest. The report showed a very considerable falling off both in production and profits. The total production from high grade ore by hand sorting was only 255,930 oz., as compared with 497,873 oz. in 1912. The grade, however, maintained its high average, the 554 tons shipped averaging 4,619 oz. a ton. The total production from the mine since the commencement of operations to the end of 1913 is 7,103,362 oz., which was shipped to the smelters in 5,251 tons of ore, averaging 1,341 oz. per ton.

As to mill ore the mill treated 32,307 tons of eighteen and half oz. ore, as compared with 40,056 tons, of 22.6 oz. ore during 1912. The falling off was due to the fact that the dump reserves were depleted during the previous year and there was insufficient ore available underground to make up the deficiency. The total production amounted to 483.796 oz., contained 516.7 tons of concentrates of an average assay of 936.3 per ton.

Owing to the narrow profits the management decided not to attempt to pay any more dividends, but to conserve all resources to opening up more ore. The report also states that the North Dome had been closed down to await better times, although there are big bodies of low grade ore and the extension of the Dome ore bodies had been discovered.

As to the possibilities at Timiskaming, Mr. Norman Fisher states: "That all the veins productive in the Keewatin formation became impoverished on entering the underlying diabase. Acting on certain deductions, work was carried out to tap new deposits in various likely places. Fortunately a good deal of success attended these efforts, even though most of those discovered were more or less erratic in occurrence and rather limited in extent. They were of much importance and provided the greater proportion of our production last year. Quite a little prospecting work was and is still being carried on in the Keewatin formation at the upper levels, but in no instance did this meet with reward. An option has, however, been taken on an adjoining property, the Duchess, where a crosscut is being run from the 250 ft. level, with the hope of picking up the extension of the Timiskaming ore bodies. The work in the diabase has resulted in some very promising discoveries."

The ore bodies while rich were, however, quite limited in extent.

Mr. Fisher says: "Owing to the changed conditions of the new occurrences in the diabase, the same blind though systematic crosscutting on preconceived lines which was carried out so extensively in the Keewatin must be repeated in the diabase before it can be safely eliminated as unproductive."

Trethewey.—The annual report of the Trethewey mine showed that while ore is much leaner and profits per ton less, ore reserves had been maintained during the year, and dividends paid out of profits. The report shows that 619,427 oz. of silver were produced and 599,036 oz. shipped at a cost of $6.65 a ton; 36,288 tons were produced at a net profit of $3.70 per ton. The costs total and summary show that development cost $1.07 per ton, breaking and stoping $2.28 per ton, milling $1.46 per ton, general expenses $.93, marketing ores $0.90, prospecting, $0.04, total $6.68 per ton.

As to ore reserves, it is stated "that an increase of 2,766 tons was made in the reserves of broken ore in the mine, while the decrease in blocked ore was 601 tons. The reserves of ore in the surface dump were drawn upon to the extent of 3,409 tons during the year. The net change in the position of the ore reserves at the beginning and end of the year is a decrease of only 1,244 tons, showing that the balance between new ore developed and ore sent to the mill has been fairly well maintained.

Very little of production came from high grade ore. 93.82 per cent. came from concentrates, which had an average value of only 234.4 oz., while high grade made up only 4.46 per cent., and bullion 1.72 per cent. The ore reserves, which amount to 585,870 oz., average 19.6 oz. per ton.

The production of silver amounted to 619,427 oz., having gross value of $365,565. The operating expenditures amounted to $204,072, leaving a net revenue from operations of $130,696, as compared with $127,834 in 1912.

Dividends paid during the past year amounted to $150,000, and after all provisions had been made the surplus carried forward was $164,148.

In regard to the option taken on the West Beaver the Port Arthur silver prospect, it is stated, that operations have been of an encouraging nature. The sum expended to the end of the year amounted to $3,757.

Hudson Bay.—The production of the Hudson Bay mine for January was 56,982 oz., which shows an increase of nearly 7,000 oz. Greater production from the veins on the lower levels accounted for the increase. The total ore concentrated during January amounted to 1,971 tons, with an average assay to the mill of 25 oz. The tailing ran 2.8 oz., giving an average per centage of extraction of 89 per cent.

Nipissing.—The Nipissing shipped fifteen and a half tons of silver from the high grade mill on Feb. 25th. This was contained in 381 bars, containing 452,335 oz. silver, valued at $260,681. This constitutes a record for the Cobalt camp, and, it is believed, for the Dominion. The large shipment was owing to the fact that the previous month the annual clean-up had taken place in the high grade plant, and it was not possible to treat much ore. It had thus accumulated.

Beaver.—The new big hoist has at last arrived at the Beaver, and is being installed. It will be able to hoist from a depth of 2,000 ft. Owing to the fact that the delivery of the hoist has been delayed, no work has been done below the 675 ft. level for some time, but it will now be proceeded with at once. The shaft is down to the 800 ft. level, and crosscutting has commenced at that depth, but the ore body had not been reached when it was found necessary to stop deep mining until a bigger hoist was obtained.

Peterson Lake.—The discovery at Peterson Lake holds out quite well. Seven ft. from the point where the high grade was first struck, the two veins have run apart and will have to be followed in separate drifts. This is now being done. The veins were always distinct. The ore in both drifts is still looking good. It contains a higher percentage of nickel than Seneca-Superior ore. The two veins aggregate about seven in. of high grade ore and assays point to the fact that there will be good milling value in the wall rock. Several tons of high grade have already been sacked and a sorting plant is now being installed at the old Kerry shaft.

BRITISH COLUMBIA

The opinion seems to be general that the current year will be an active one in mining in British Columbia, and in this connection several Provincial legislators have made optimistic speeches that have been pleasant to hear and reports of which have made good reading. The satisfactory part of the position is that while sometimes a speaker could easily be cornered if he were required to give specific reasons for "the faith that is in him," those familiar with details of mining work in progress or being prepared for are possessed of much information that should be regarded as fully justifying a favorable view of the outlook for mining in this Province in 1914, of course, providing that no unforeseen preventive conditions shall be experienced to prove unusual obstacles to progress.

A rapid survey of the situation will indicate in a general way grounds for confidence in the near future of the mining industry of British Columbia. Glancing at the districts in the order in which they stand in official publications, the following is a brief summary:

Cariboo placer-gold mines have promise of at least an ordinary supply of water for hydraulicking purposes. In Cassiar district placer-mining should be extended, for there has been much activity, even during the winter, in parts of Atlin mining division; preparation was made last season for operations on several streams in Omineca division; and in Stikine and Liard divisions, especially about Dease lake, placer-mining is again receiving attention.

Lode mining in the northern country is gradually being developed, in small degree in Atlin division, with promising results in Portland Canal camps, with a prospect of early shipment of ore from Moresby island of the Queen Charlotte group, ore production in active progress about Hazelton, and practical completion of provision for important mining and smelting operations at Granby bay, Observatory inlet.

In East Kootenay, coal mining conditions are favorable to last year's record results being equalled, if not exceeded; and lode mining may also be expected to be maintained on at least the 1913 scale, though a large output of ore from the Sullivan mines is probable and an improvement in the St. Eugene may be looked for.

Ainsworth mines are doing better as a whole than for a number of years; in Slocan division, at least a dozen mines are being worked and quite half that number, with excellent results and with assurance of still further improvement; mining in Nelson division is on a better footing now than for years, with 15 to 20 mines being worked and production being gradually increased; in Rossland camp there is full confidence that years of profitable production may be relied on, so favorable have been the results of deep development work during the last year; in Boundary district, the big copper mines have several years' ore supply in sight, and two or three small mines are now being worked to advantage; in Similkameen district, the Hedley Gold Mining Co. is spending $200,000 to provide power for enlarged mining and milling operations, and the British Columbia Copper Co. is making financial provision for utilizing the large quantity of ore its exploration and development work of the last two years have demonstrated is available on Copper mountain; at both Kamloops and Lillooet there should be increased production, though not yet on a large scale; completion of construction of railway lines may be expected to greatly benefit coal mines in Nicola valley by giving them connection with new markets for their product; and on the lower coast, copper mining at the Britannia mine, and a gradual recovery from the bad effects of last year's labor difficulties at Vancouver Island coal mines, will each add its quota to the sum total of progress that is regarded as reasonably certain.

Ainsworth and Slocan.

Ore Shipments.—Three mines in Ainsworth division have continued shipment of ore throughout the winter, these being the Consolidated Mining and Smelting Co.'s Highland and No. 1 mines, both having aerial tramway connection with the lake front near the town of Ainsworth, and the Bluebell, situated at Riondel, across Kootenay lake from Ainsworth. Totals for seven weeks to February 19 were as follows: Highland, 395 tons; No. 1, 977 tons; Bluebell, 923 tons. The Bluebell ships lead-silver concentrate, so the quantity shipped may be taken as having been the lead product of 8,000 to 9,000 tons of ore put through the concentrator. It has been the custom to save the zinc middling for later disposal. The other mines probably ship crude ore, although both have tramway connection with the Highland concentrator. The Silver Hoard, also in Ainsworth camp, has not sent out much ore during the latter part of the winter, only one lot, of 44 tons, having been received at the Trail smeltery during the period above mentioned. Receipts of Silver Hoard ore during 1913, however, totalled 1,287 tons; more development work done during the winter, and additions to mine equipment, together warrant the expectation of an enlarged output after winter disadvantages shall no longer be experienced. Other properties being worked include the Florence Mining Co.'s claims, a few miles north of Ainsworth; the Utica, about 18 miles east of Kaslo; and J. L. Retallack & Co.'s Whitewater group.

New Power Supply.—The Consolidated Co. has been putting in Pelton wheels and an electric generator, to be operated by water obtained from Cedar creek at an elevation of about 1,000 ft. above the Highland mill, where the current is generated to drive compressor and other machinery there. Air pipe lines from the mill to the Highland and No. 1 mines provide for supply of power for operating drills, etc., in those mines. The Taylor hydraulic compressor on Coffee creek will supply air for drilling on several properties on which the Consolidated Co. is doing development work under option of purchase.

The Black Bear group of mineral claims, situated near Sproule, a few miles east of Whitewater, has been bonded by Mr. J. J. Hennessy, of Spokane, Washington, for United States men, who intend commencing development work on this property as soon as the snow shall melt and supplies can be sent in.

The Eagle Lode Mining Co., of Spokane, has been doing development work on the Eureka group, about four miles from Sproule, and expects to make a shipping mine there.

On the Valdes Islands.

Valdes Island Copper Co.—For a number of years mineral claims situated on what is now known as the Valdes group of islands, lying between Vancouver island and the mainland of British Columbia, have been worked intermittently, some at one time and others at another. Last year some claims situated on Quadra island, one of the group, had the attention of the Valdes Island Copper Co., with which the late Jas. D. Sword was associated until his death by drowning recently, when proceeding in a launch from the mining property to the mining recorder's office at

Quathiaski cove. The company has been opening several big deposits of copper-bearing magnetite, and is now preparing to construct a wagon road to allow of ore being hauled to tidewater for shipment, thence to one of the copper smelters. Beside the group of claims on Quadra island, the company has a small island in the neighborhood on which similar ore occurs, and this, too, has been developed to some extent by open cuts during the last year. It is expected that smelter returns will be good and that results will well warrant mining the ore on a fairly large scale.

On Queen Charlotte Islands.

The Tassoo Copper Syndicate, of Vancouver, of which Mr. Robert R. Hedley is manager, is preparing to make a shipment of about 500 tons of ore from its mine, on Moresby island of the Queen Charlotte group, to the Tacoma smelter. An aerial tramway 2,300 ft. long will give communication between the mine and a shipping place on Tassoo harbor. There is excellent harborage in an arm of that harbor, an island 200 acres in extent, affording protection against strong winds from the sea. No dock is needed; only a float between the vessel unloading or taking on cargo, to keep it away from the rocky shoreline. The ore averages two per cent. in copper and rather less than $1 a ton in gold and silver. The nature of the ore is such that a very favorable smelting rate has been obtained for it.

The Metropolitan Trust Co., of New York City, is planning to diamond drill its coal lands on Graham island, of the Queen Charlotte group, under the direction of Dean Milnor Roberts, of Seattle, Washington, who spent part of last season on the property doing surface exploration. Mr. W. L. Barton, of Queenstown, Moresby island, will be head driller. Drilling will be commenced in March and two drills will be used—one with which a depth of 1,500 can be reached and the other a small one. The company controls many thousands of acres in what are known as the Robertson and Wilson fields, respectively.

Portland Canal Mining Division.

Indian Mines, Ltd.—While the most important mining operations in progress in this division during the winter now drawing to a close have been those of the Portland Canal Tunnels, Ltd., work has also been done on other properties. Prominent among these is that of the Indian Mines, Ltd.—a group of claims situated in what is known as the Salmon River region, and on which one of the veins, containing ore of excellent grade is being drifted on. Near the surface there is a deposit of ore 19 ft. in width, and on this a prospect shaft was sunk 25 ft., and the ore taken out was estimated to average about 40 per cent. lead, 20 oz. silver to the ton and a little gold. An adit was driven with the object of opening this shoot of ore at about 165 ft. depth; at 200 ft. in from the portal this drive entered a body of ore which filled the face of the working. It was expected that it would require another 50 ft. of driving to get under the ore shoot opened from the surface.

Montana Group.—Recently four tons of ore was sent to the smelter at Tacoma, Washington, from the Montana group, on Marmot river, for test purposes. Development work done on this property has exposed a considerable quantity of ore, believed to be of good grade. The owners are awaiting receipt of smelter returns before deciding whether to continue work themselves or lease the property.

Portland Canal Tunnels, Ltd.—Late reports from the scene of the operations of the Portland Canal Tunnels, Ltd., which has driven an adit a distance of about 3,000 ft., with the object of cutting at depth veins of ore opened from the surface on the property of the Portland Canal Mines, Ltd., and neighboring groups, have been encouraging, and the prospects are believed to be favorable for profitable working of the ore shoots found in three veins on which drifting has been done from the low level adit. Where crosscut, the veins did not show ore of commercial value, though they are in places of considerable width. Latterly, ore mineralized with pyrite and galena has been found, and the outlook is now regarded as being distinctly favorable for successful operation of the properties, in connection with working which suitable arrangements were made before the crosscut adit was driven. Beside providing for mining under far more advantageous conditions than attended the operations of the several companies that opened the veins from the surface, the driving of this long adit will facilitate the development of a water-power in which the Tunnels Co. is also interested. The outlook for mining in this part of Portland Canal mining division has been much improved by the results of the enterprising policy of the Tunnels Co., for other companies will now be encouraged to also undertake work at greater depth than heretofore.

Near Hazelton, Skeena District.

Silver Standard Mine.—There is much activity at the Silver Standard Mine, on Glen mountain, distant about five miles from the old town of Hazelton, Skeena district, and six miles from the nearest point on the Grand Trunk Pacific Railway. Ore is being hauled to the railway and taken thence to Prince Rupert, from which port it is conveyed in steamers to Vancouver and then by rail to the Consolidated Mining and Smelting Co.'s reduction works at Trail, West Kootenay. Freight charges are consequently heavy, yet this, notwithstanding, shipment of the ore is being continued, several hundred tons having lately been sent to the smelter. An idea of the metal contents of the ore can be obtained from the following return from 282 tons shipped last summer: Metals paid for by the smelter —gold 63 oz., silver 40,883 oz., lead 149,525 lb., total value $30,001.61., or an average of $106.42 a ton. The property is owned by the well-known railway contractors, Stewart & Welch, with whom are associated Mr. McLeod and others. Small shipments are being made from the American Boy group, on Nine-mile mountain, owned by the Harris Mines, Ltd. One carload lot from this property reached Trail several weeks ago.

STEEL PRODUCTION FOR 1913.

The output of the Steel Company of Canada for 1913 was as follows:

	1912. Tons.	1913. Tons.	Increase.
Pig Iron	174,082	180,712	6,630
Open hearth ingots ...	89,456	157,661	68,205
Iron and steel bars ...	156,032	192,509	26,477

The output of the Canada Iron Corporation is as follows:

Pig iron output during 1912 88,163 gross tons 970 lbs.
Pig iron output during 1913 62,524 gross tons 839 lbs.

Decrease. . . . . 25,639 gross tons 140 lbs.

CARIBOU COBALT.

A 2½ per cent. dividend has been declared on the capital stock of the Caribou Cobalt Mines Co., payable on March 30th.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto, Ont.)

March 9, 1914.

New York Curb.

	Bid.	Ask.
Alaska Gold	21.50	22.00
British Copper	1.50	1.62
Braden Copper	7.50	7.62
California Oil	336.00	338.00
Chino Copper	40.00	40.62
Giroux Copper	1.00	1.25
Green Can.	38.00	40.00
Granby	81.00	88.00
Miami Copper	22.50	23.00
Nevada Copper	15.00	15.50
Ohio Oil	174.00	178.00
Ray Cons. Copper	19.50	19.75
Standard Oil of New York	217.00	220.00
Standard Oil of New Jersey	410.00	412.00
Tonopah Mining	6.87	7.00
Tonopah Belmont	7.75	8.00
Tonopah Merger	.60	.62
Inspiration Copper	16.50	16.87
Goldfield Cons.	1.68	1.81
Yukon Gold	2.87	3.00

Porcupine Stocks.

Apex	.02½	.02¾
Dome Extension	.11½	.12
Dome Lake	.36	.37
Dome Mines	16.00	16.50
Foley O'Brien	.19	.21
Hollinger	16.00	16 25
Jupiter	.14	.14¼
McIntyre	1.33	1.35
Moneta	.02	.03
Northern Exploration	2.50	3.00
North Dome	.15	.17
Plenaurum	.40	.60
Pearl Lake	.09	.09½
Porcupine Gold	.13	.13½
Imperial	.01⅝	.02
Porcupine Reserve	..	.06
Preston East Dome	.01⅞	.02
Rea	.15	.20
Standard	..	.00½
Swastika	.04	.04⅛
United	..	.01
West Dome	.15	.20
Porcupine Crown	1.27	1.32
Teck Hughes	.20	.30

Cobalt Stocks.

Bailey	.05	.05¼
Beaver	.30½	.31
Buffalo	1.60	1.72
Canadian	..	.10
Chambers Ferland	.18½	.19
City of Cobalt	.40	.50
Cobalt Lake	.67	.70
Coniagas	8.00	8.10
Crown Reserve	1.83	1.85
Foster	.08	.09
Gifford	.03	.04
Gould	.03	.03¼
Great Northern	.15	.15¼
Hargraves	.02	.03
Hudson Bay	71.00	72.00
Kerr Lake	4.70	4.75
La Rose	1.68	1.72
McKinley	1.22	1.27
Nipissing	6.80	6.84
Peterson Lake	.42½	.43
Right of Way	.04	.04½
Rochester	.02	.03
Leaf	.02	.02½
Cochrane	.35	.40
Silver Queen	.03	.04
Timiskaming	.17¾	.18
Trethewey	.24	.26
Wettlaufer	.06	.07
Seneca Superior	2.90	3.20

TORONTO MARKETS.

March 11.—(Quotations from Canada Metal Co., Toronto):
- Spelter, 5¼c. per lb.
- Lead, 5¼c. per lb.
- Tin, 40c. per lb.
- Antimony, 8½c. per lb.
- Copper, casting, 15½c. per lb.
- Electrolytic, 15¼c. per lb.
- Ingot brass, 10 to 15c. per lb.

March 11.—Pig iron.—(Quotations from Drummond, McCall & Co., Toronto):
- Summerlee No. 1, $26.50 (f.o.b. Toronto).
- Summerlee No. 2, $25.50 (f.o.b. Toronto).

March 11.—Coal—(Quotations from Elias Rogers Co., Toronto):
- Anthracite, $8.25 per ton.
- Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

March 9.—Connellsville coke (f.o.b. ovens).
- Furnace coke, prompt, $2.00 per ton.
- Foundry coke, prompt, $2.40 to $2.60 per ton.

March 9.—Tin, straits, 37.55c.
- Copper, Prime Lake, nominal.
- Electrolytic copper, 14.25 to 14.35c.
- Copper wire, 15.50c.
- Lead, 4.00c.
- Spelter, 5.30 to 5.40c.
- Sheet zinc (f.o.b. smelter), 7.25c.
- Antimony, Cooksons, 7.20 to 7.25c.
- Aluminum, 18.50 to 18.75c.
- Nickel, 40.00 to 45.00c.
- Platinum, hard, 10 per cent. $46.00 to $47.50 per oz.
- Platinum, hard, 20 per cent. $49.00 to $51.50 per oz.
- Platinum, soft, $43.00 to $44.00 per oz.
- Bismuth, $1.95 to $2.15 per lb.
- Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
February.		
24	57⅝	26⅝
25	57½	26 9/16
26	57½	26 9/16
27	57½	26 9/16
28	57⅝	26⅝
March.		
2	57¾	26 11/16
3	57¾	26 11/16
4	58¼	26⅞
5	58½	27
6	58¼	26⅞
7	58	26⅞
9	58⅛	26 13/16
10	58⅛	26 13/16

"Tested Packings for Every Purpose"

This pamphlet is an authentic text-book---a complete illustrated guide---to standard lines of tested packings.

We shall be glad to send you a copy, gratis.

Canadian Consolidated Rubber Company, Limited

MONTREAL

Please use this Coupon ☞

Canadian
Ronsolidated
Cubber Co., Ltd.,
Montreal.

Gentlemen :

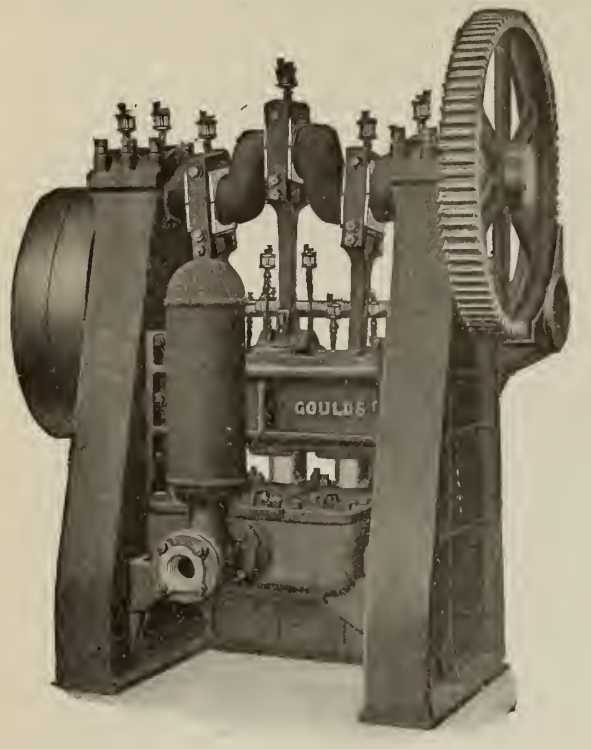
Please send me a complimentary copy of "Tested Packings for Every Purpose."

Name.....

Address.....

.....

C.M.J.



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam Shovels**: **Specially Flexible** Ropes for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:—

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. **New Brunswick: W. H. Thorne & Co., Ltd., St. John.**
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & Deyel
Heys, Thos. & Son.
Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd
Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place
New York City

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

What is your specialty ?
What is your address ?
Our readers want to know.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

MAURICE W. SUMMERHAYES
Mining Engineer,
McENANEY MINES
Schumacher P.O., - Ont.

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

COMPRESSED AIR PRACTICE

By FRANK RICHARDS

If you do not know all about Compressed Air and wish to learn something about it, this book will be of service to you. It is written for the many rather than the few. It is easy to read and contains much useful information. Price, $3.00.

Book Department, Canadian Mining Journal, 44-46 Lombard Street, Toronto

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 **ADELAIDE STREET WEST**
TORONTO, ONT.

WANTED. First-class Master Mechanic for large gold mine. Apply Box "F," Canadian Mining Journal, Toronto, Can.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

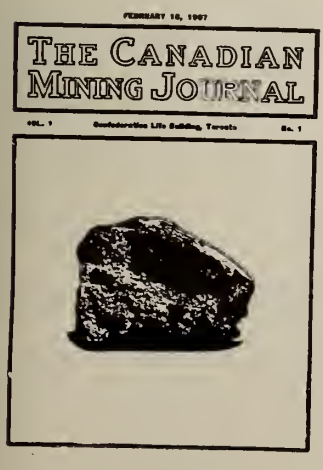
Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

WANTED. Chemist and Assayer with cyaniding experience, capable of looking after cyanide plant. Apply Box "E," Canadian Mining Journal, Toronto, Can.

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

WANTED—DRAUGHTSMAN familiar with Mill Work. State Experience and Salary Wanted.
Moose Mountain, Limited, Sellwood, Ont.



The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

1085. Descriptive Sketch of the Geology and Economic Minerals of Canada. Accompanied by a geological and mineral map of Canada, by G. A. Young and R. W. Brock.
Guide Books to excursions of the International Geological Congress.
1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1165. Memoir No. 18. Bathurst District, New Brunswick, by G. A. Young. Maps not yet published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1220. Memoir 29. Oil and gas prospects of the Northwest Provinces of Canada, by Wyatt Malcolm.

BRITISH COLUMBIA

1206. Memoir No. 26. Geology and Mineral Resources of the Tulameen District, B.C., by Charles Camsell.
1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1042. Mineral Map of Canada. Scale 100 miles to 1 inch.
1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1208. Map 53A. Southeast Nova Scotia. Scale 4 miles to 1 inch.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
1300. Map 100A. Bell River, Quebec. Geology.

ONTARIO

1177. Map 31A. Larder Lake, Nipissing District, Ontario. Geology.
1244. Map 64A. Advance geological copy of map of Gowganda Mining Division and vicinity.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.
1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.
1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.
1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1195. Map 45A. Tulameen, Yale District, British Columbia. Topography.
1196. Map 46A. Tulameen, Yale District, British Columbia. Geology.
1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.
1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.
1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.
1304. Map 106A. Groundhog coal field, British Columbia. Geology.
1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

YUKON and NORTH WEST TERRITORIES

1089. Map 9A. Explored routes on parts of the Albany, Severn and Winisk Rivers. Scale 8 miles to 1 inch.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

WATERWORKS PUMPS

High Duty Horizontal Compound and Vertical Triple Expansion

PUMPING ENGINES

Capacities from One-Half Million to Thirty Million Gallons per twenty-four hours

Specifications on Request

The John Inglis Co., LIMITED

Boilermakers and Engineers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea

ALL DESCRIPTION OF METALS, MATTES, Etc.

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners

BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office: 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE

WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of

Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition

Bell Telephone 603, St. Catharines

Back or Current Numbers

of any American or Foreign technical or trade Journal furnished on short notice at moderate rates; also newspapers and magazines. Government and State Reports of all kinds in stock. Clippings on special subjects furnished promptly. Magazines and papers of all kinds bought.

Special subscription price list on request.

A. W. Castellanos

263 Armstrong Avenue
Jersey City, N.J., U.S.A.

LIDGERWOOD

See the Shock-Absorbing Carrier Tops!

These Did It

Panama-Type High-Grade Cableways

The Lidgerwood Cableways designed for building the six locks on the Panama Canal at Gatun were guaranteed to operate at 1800 feet per minute carriage speed and have exceeded this guarantee. This speed nearly doubles the former capacity of cableways.

See the Swinging Eye!

The limiting features to Cableway Carriage Speed was the ability of Fall-rope carrier to withstand Shock.

Panama-Type Carriers have been operated without damage at 3,000 feet per minute.

CANADIAN ALLIS-CHALMERS, LIMITED

Head Office: Toronto.

District Sales Offices: Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Victoria, Vancouver, Prince Rupert.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co. 22
Amatite Roofing 13
American Diamond Rock Drill Co. 16
Astley, J. W. 23

B

Bartlett, C. O., & Snow Co. 17
Bath, Henry & Son 28
Beatty, M. & Sons, Ltd. 11
Belleville Assay Office 25
Bennett, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons 16
Blackwell, Geo. G., Sons & Co. ... 28
British Columbia, Province of ... 18
Brown & Butters 23
Burchell, Geo. B. 23
A. M. Byers Co. 14

C

Canadian Allis-Chalmers, Ltd. 29
Campbell & Deyell 25
Canadian Bag Co. 13
Canadian Bank of Commerce 8
Canadian Cleveland Drill Co 9
Canadian Consolidated Rubber Co, Ltd. 21
Canadian Copper Co. 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Laboratories, Ltd. 25
Canadian Northern Steamships ... 6
Canadian Ingersoll-Rand Co., Ltd. 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith 23
Castellanos, A. W. 28
Cohen, S. W. 23
Colvocoresses, G. M. 23
Consolidated Mining & Smelting Co 28
Coniagas Reduction Co., Ltd. 28
Curtis's & Harvey .....
.....Outside back cover

D

Dept. of Mines, Canada 26
Deloro Mining & Reduction Co... 28
DePencier, H. P. 23
Diamond Drill Contracting Co..... 16
Dominion Coal Co., Ltd. 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co. 16
Donald, Dr. J. T. 25
Drury, H. A. Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W. 23

F

Ferrier, W. F. 23
Fleck, Alex. 6
Flory, S., Mfg. Co. 12
Forbes, D. L. H. 23
Fowler, S. S. 23
Fraser & Chalmers of Can., Ltd.... 4
Federal Engineering Co., Ltd. 31

G

Graham, S. N. 23
Gray, John 25
Greening, B., Wire Co., Ltd. 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John 24
Hardman, J. E. 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd. 25
Heys, Thos. & Son 25
Hille, F. 24
Holman Drill Co. 20

I

Inglis, John & Co., Ltd. 27
Imperial Bank of Canada 2
Industrial Technical Press 19
International Nickel Co. 8
International Engineering Works Ltd. 11

J

James Ore Concentrator Co. .....
.....Outside back cover
Jeffrey Mfg. Co. 19
Jenckes Machine Co., Ltd. .....
.....Inside front cover
H. W. Johns-Manville Co., Ltd. ... 9
Johnson, W. S. 24
Jones & Glassco 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co. 25
Loring, F. C. 24
Lymans, Limited 9
Lands of the Algoma Central and Hudson Bay Ry. 3

M

Herbert Morris Crane & Hoist Co., Ltd. 16
Morton, B. K. & Co. 18
McEvoy, James 24
Mussens, Limited .....
.....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co. 10
Nova Scotia, Province of 15
Northern Canada Supply Co., Ltd. 6

O

Orenstein-Arthur Koppel Co 5
Orford Copper Co. 8
Ontario, Province of 30

P

Paterson Mfg. Co. 13
Peacock Bros. 7
Pickings, H. B. 24
Pyke, James W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd. 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Segsworth, W. E. 24
Siemens Company of Canada, Ltd. 35
Smart-Turner Machine Co. 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd. .....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Sullivan Machinery Co. 2
Summerhayes, Maurice W. 24
Swedish Steel & Importing Co., Ltd. 12

T

Jeo. Taylor Hardware Co., Ltd. ... 4
Toronto University 2
Tyrrell, J. B. 24

W

Willmott, A. B. 24
Walker Bros. 7

LANCO BALATA BELTING

This belt will stand up under extremes of cold, wet or dry conditions. It is as stretchless as it is possible to make a belt. Impregnated with pure balata gum by our own secret process. Write for our new illustrated book of belting information,—"The Main Drive."

Federal Engineering Co., Limited

TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.
Geo. Taylor Hardware Co,Ltd

Bags—
Canadian Bag Co., Ltd.
Smart-Woods, Ltd.

Ball Mills—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineering Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd
Curtis & Harvey (Canada), Limited.
Mussens, Ltd.
Northern Canada Supply Co.

Blowers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.

Boilers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
The John Inglis Co., Ltd.

Buckets—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd

Cable — Aerial and Underground—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Cables—Wire—
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.

Carriers—
The Herbert Morris Crane & Hoist Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co.

Case Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Cement Machinery—
Canadian Allis-Chalmers, Ltd
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.

Chain Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell
Thos. Heys & Son
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Handling Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Compressors—Air—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd
Laurie & Lamb
Canadian Westinghouse
Can. Ingersoll-Rand Co. Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.

Condensers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Bros.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Waterous Engine Works
Canadian Fairbanks-Morse Co., Ltd.

Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Gantry—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Hand Power—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith
B. Greening Wire Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Lymans, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roessler & Hasslacher
Mussens, Ltd.
Thos. & Wm. Smith
Peacock Bros.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Canadian Allis-Chalmers, Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Can. Ingersoll-Rand Co., Ltd

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Ltd.
Orenstein-Arthur Koppel Co.

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Elevators—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Peacock Bros.

Engineering Instruments—
C. L. Berger & Sons
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Mussens, Ltd.
Alex. Fleck
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
M. Beatty & Sons
Canadian Westinghouse
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.
Can. Fairbanks-Morse Co.

Engines—Oil—
Peacock Bros.
Can. Fairbanks-Morse Co.

Engines—Steam—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.
Robb Engineering Co.
S. Flory Mfg. Co.
Alex. Fleck
Peacock Bros.
M. Beatty & Sons
Laurie & Lamb
Mussens, Ltd.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Filters—
Krupp, Fried, A. G., Germany

Friction Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.

Forgings—
M. Beatty & Sons
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Bros.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :					Halifax
QUEBEC :					Montreal
ONTARIO :	Toronto,	Cobalt,	South Porcupine,	Port Arthur,	Kingston
MANITOBA :					Winnipeg
ALBERTA :					Edmonton
BRITISH COLUMBIA :	Vancouver,	Victoria,	Nelson,		Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krup, Fried. A. G., Germany
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey, (Canada), Limited
Canadian Westinghouse
Canadian Explosives
Mussens, Ltd.
Northern Canada Supply Co.

Gears—
Canadian Westinghouse
Krupp, Fried. A G., Germany
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Girders—Steel—
Dominion Bridge Co.

Gravity Lowering Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Hangers—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Heaters—Feed Water—
Mussens, Ltd.
Laurie & Lamb
Canadian Westinghouse
Peacock Bros.
Fraser & Chalmers, Ltd.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
S. Flory Mfg. Co.
Jones & Glassco
Waterous Engine Works
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Ltd.
Waterous Engine Works.

Hose—
Can. Genl. Electric Co., Ltd
H. W. Johns-Manville Co.
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Can. Cleveland Drill Co.
Northern Canada Supply Co.

Jacks—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives
Peacock Bros.
Ackroyd & Best
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works
Northern Canada Supply Co.
Jones & Glassco

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.
Canadian Westinghouse
Siemens Co. of Canada, Ltd.

Locomotives—Steam—
Mussens, Ltd.
Canadian Westinghouse

Metal Merchants—
Henry Bath & Son
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Jeffrey Mfg. Co.
Canadian Westinghouse
Peacock Bros.
Siemens Co. of Canada, Ltd.

Ore Sacks—
Canadian Bag Co.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Ore Testing Works—
Ledoux & Co.
Can. Laboratories
Milton Hersey Co., Ltd.
Campbell & Deyell

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada
Krupp, Fried, A. G., Germany
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
Northern Canada Supply Co.
Thos. & Wm. Smith
Peacock Bros.

Pipes—
Consolidated M. & S. Co.
Peacock Bros.
Laurie & Lamb
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Canadian Westinghouse
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Jones & Glassco

Producer—Gas—
Krupp, Fried, A. G., Germany
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
Smart-Turner Machine Co.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Laurie & Lamb
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Alex. Fleck
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Jeffrey Mfg. Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumatic—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Can. Ingersoll Rand Co., Ltd.

Pumps—Steam—
Can. Ingersoll-Rand Co. Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
Alex. Fleck
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A. G., Germany
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany

Rolls—Crushing—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Can. Allis-Chalmers, Ltd.

Roofing—
Paterson Mfg. Co.
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.
Geo. Taylor Hardware Co,Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany
Thos. Heys & Son

Screens—
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
R. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Self Landing, Self Delivery Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Mussens, Ltd.
M. Beatty & Sons

Slime Tables—
Deister Concentrator Co.
James Ore Concentrator
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Smelting Machinery—
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drills—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A G., Germany
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd

Steel—Tool—
Mussens, Ltd.
Thos. & Wm. Smith
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley
C. L. Berger

Switchboards—
Canadian Westinghouse
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.

Transformers—
Canadian Westinghouse
Can. Fairbanks-Morse Co.
Peacock Bros.
Siemens Co. of Canada, Ltd.

Transits—
C. L. Berger & Sons
W. F. Stanley
Peacock Bros.

Tractors—Oil—
Can. Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse
Peacock Bros.
Laurie & Lamb
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Winding Engines—
Waterous Engine Works
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Wire Cloth—
Can. Allis-Chalmers, Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Standard Underground Cable Co., of Canada, Ltd.

Wire—Magnet—
Standard Underground Cable Co. of Canada, Ltd.

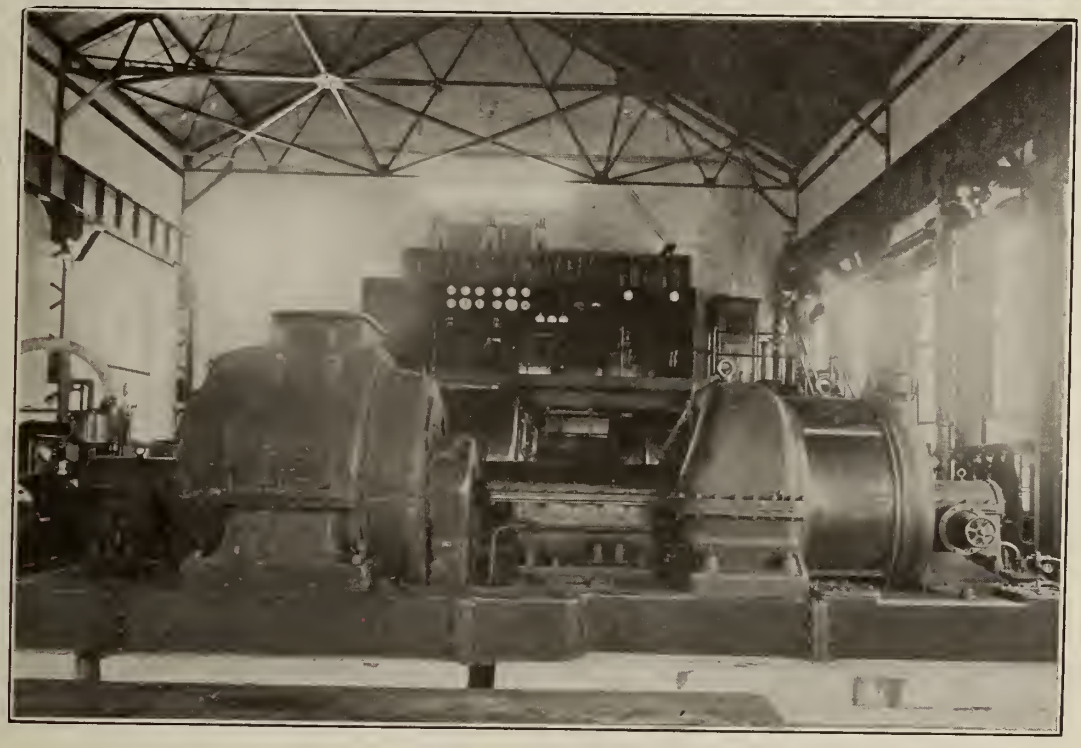
Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS—SCHUCKERT | SIEMENS & HALSKE



Siemens 2,500 K.W., 25 cycle, 6,600 Volt Turbo Generator with Switchboard, supplied to the Dominion Coal Company, Nova Scotia.

The following Siemens **Turbo Generators** have been supplied or are on order for Canada.

1—4000 K.W. Edmonton.
1—3000 K.W. Regina.
1—2500 K.W. Dominion Coal Co.
1—2000 K.W. Dawson City
1—2000 K.W. Dawson City.
1—2000 K.W. Dawson City.
1—2000 K.W. Edmonton.
1—1500 K.W. Regina.
1—1500 K.W. Regina.
1—1500 K.W. Moose Jaw.
1—1200 K.W. Lethbridge.
1— 750 K.W. Nova Scotia Steel & Coal Co.
1— 675 K.W. Medicine Hat.
1— 675 K.W. Medicine Hat.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Wayagamack Pulp & Paper Co.

The Siemens Companies manufacture Turbo Generators in **single units of 30,000 H.P.**

"The Siemens Companies undertake the complete electrical equipment of mines, collieries, steel works, rolling mills, pulp and paper Mills, and electrical plants of every description, and specialize in **Electric Hoisting Engines.**"

Siemens Company of Canada, Limited

HEAD OFFICE
TRANSPORTATION BUILDING - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

For constant speed, continuous service in your mine use

Westinghouse Induction Motors

Their simplicity, efficiency, reliability and strong construction insure long service at the lowest cost.—The only wearing parts, the bearings, have a large surface, and are self-oiling.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Square	Ahearn & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

—— FOR REGULATIONS, MAPS, ETC., APPLY TO ——

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M. A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— Published by —

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

— which also publishes —

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

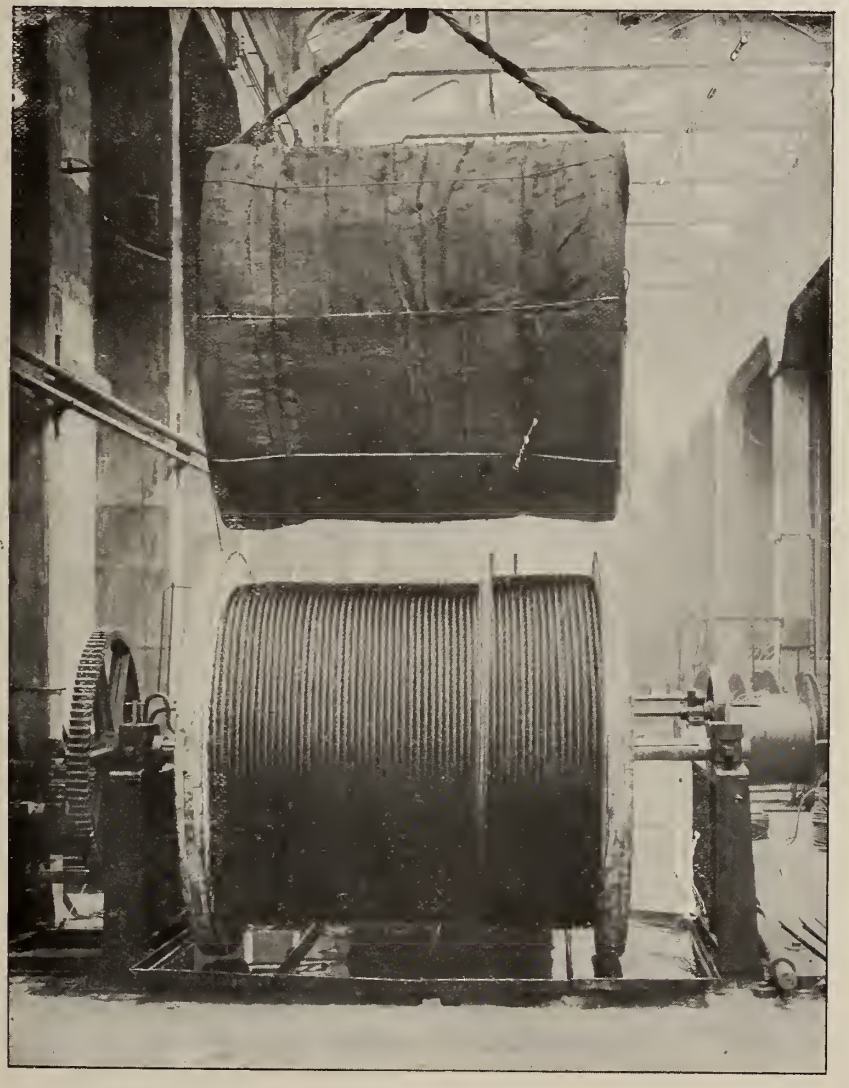
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.

The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

Full Strength - Uniformity

— make —

CURTIS'S & HARVEY (CANADA) LIMITED
DRAGON BRAND

EXPLOSIVES

The Best on the Market

MONTREAL
400 St. James Street

COBALT
Royal Exchange Bldg.

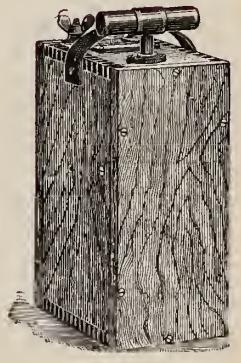
APRIL 1, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

OL. XXXV TORONTO No. 7

BLASTING OUTFITS

White Jacket Safety Fuse



Never Runs. Never Misses Fire.
Burning Speed Extremely Regular.

Blasting Batteries, Detonators, Etc.,

CARRIED IN STOCK

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER 101 Water St.
QUEBEC 31 St. Louis St.
ST. JOHN, N.B. 57 Symthe St.
HALIFAX 78 Granville St.

LIDGERWOOD - CRAWFORD

EXCAVATOR

Steam or Electrically Driven

For Placer and Surface Mining

Irrigation and Drainage Ditches, Open Cut Work of every description

Built in Sizes With Booms From 40 ft. to 115 ft. in Length

and With Buckets from One to Two and One-half Cubic Yards Capacity

SEND FOR BULLETIN 103

CANADIAN ALLIS-CHALMERS, Limited

Manufacturers of Air Compressors, Avery Scales Boilers, Cement Making Machinery, Concrete Mixers, Flour Mill Machinery, Gas Engines, Hoisting Engines, Hydraulic Machinery, Lidgerwood Engines and Cables, Locomotives, Mining Machinery, Ornamental Metal Work, Rock Crushers, Rock Drills, Saw Mill Machinery, Steam Pumps, Steam Specialties, Steam Shovels, Steam Turbines, Structural Steel, Transmission Machinery, Turbine Pumps, Water Pipe, Water Wheels.

HEAD OFFICE: TORONTO. DISTRICT SALES OFFICES: MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER, PRINCE RUPERT,

The Great 42

This cut illustrates the Kennedy Gyratory Crusher No. 42 which is to be installed on section No. 3 Welland Canal.

There are 14 fundamental reasons why this crusher was selected.

Write us and obtain the interesting details which show why Kennedy heavy duty machinery increases the efficiency, economy and profit of any crushing operation.

All Sizes of

Gyratory, Roll Hammer AND Jaw Crushers,

Revolving and Pulsating Stone Screens. Rock Drills for every requirement.

FJAB DRILL STEEL, Hollow or Solid, stands for Quality, Uniformity, Reliability, Economy. Once adopted, always used

Rock & Power Machinery

Limited

Exclusive Agents in Canada for the Kennedy Manufacturing and Engineering Co.'s Complete Line of Rock and Ore Crushing Equipment.

Agents for the Bawden Steam and Sinking Pumps.

HEAD OFFICE: 12 King Street East, Toronto. Ont.

BRANCH OFFICES:

VANCOUVER; CALGARY; WINNIPEG; SUDBURY; COBALT; OTTAWA; MONTREAL; HALIFAX, AND IN THE KING EDWARD HOTEL, TORONTO

Imperial Bank
of Canada
Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Subscribed	$7,000,000
Capital Paid Up	6,992,000
Reserve Fund	7,000,000

Branches in Northern Ontario at
Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of
Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

The World's Safety Lamp Experts
Ackroyd & Best, Ltd.
Morley, - Leeds, England
have the best equipped Factory and Staff in the World for the accurate production of high-class SAFE SAFETY LAMPS and Lamproom and Underground Equipment for same. Cleaning Machines; Filling Machines; Lampstands; Cleaning Benches; Glasses and Cleaning Brushes, etc.

For full particulars apply: **Ackroyd & Best, Ltd.**, No. 2 Arrott Power Buildings. Barker Place, Pittsburgh, Pa., U.S.A.
Telephone Nos.---P. & A. Tel. Main 2217. Bell, - - - Grant 1619

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

For Calendar and other information apply to the Secretary,
A. T. LAING

THERE'S A SULLIVAN DRILL

Sullivan "Liteweight" Drill with Water Jet for Laying Dust.

Just suited to excavate rock most rapidly, and at least cost, under YOUR working conditions.
Efficiency in boring holes in rock has been our constant study for more than forty years.
If you require 50-foot holes under water, in river or harbor work—if you need deep blast holes on a bench or in an open pit—if you have a tunnel to drive in the shortest possible time, if your ground is hard and tight, or soft and loose, if you are looking for air and repair economy, as well as for high speed, you can be sure that the Sullivan Drill recommended to you by Sullivan Drill Engineers is the most efficient drill you can select for your particular service.

Haven't You Got Some Holes to Drill?

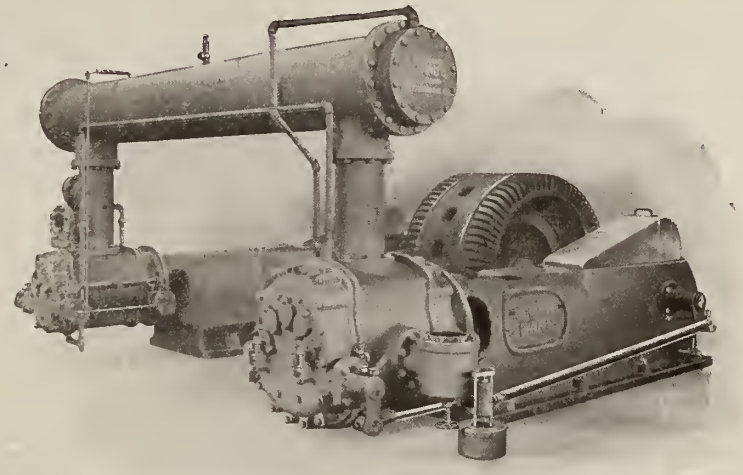
Send for Prices and Bulletin 666-H.

AIR COMPRESSORS COAL CUTTERS DIAMOND DRILLS STOPERS

SULLIVAN MACHINERY COMPANY
122 So. Michigan Avenue, Chicago, Ill.

Montreal Cobalt Nelson, B.C. Spokane Vancouver

INGERSOLL-RAND CLASS "RE" COMPRESSOR HIGH-SPEED DIRECT CONNECTED TYPE, WITH ENCLOSED DUST-PROOF FRAMES. CATALOGUE K-92 GIVES A DETAILED DESCRIPTION. SEND FOR IT. ∴ ∴



Commercially Efficient Air Compressors

You may not think of it in just these terms, but what you have in mind—what you are seeking—in the compressor you're going to buy, is *commercial efficiency.*

Now, commercial efficiency is another name for earning power—the ability to show a fair interest on the investment. You hope that your investment will continue to pay interest long after the amount of the principal has been returned to you.

Ingersoll-Rand Compressors are built with dividend-earning power (as well as operating economy) in view. They are not made merely for record-breaking performance under test, but also for all-round, high-duty, dependable service over long periods.

They consistently embody design, materials and workmanship of a character which will give the best results under day-after-day, year-after-year operation.

They are designed to be—and are—the choice of those keen-sighted buyers who demand a machine in which all essential features are merged in a unit of maximum commercial efficiency.

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works : SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

Send Us the Particulars of Your Requirements

Blake Crushers	Shoes and Dies	Trommels
Dodge Crushers	Stamp Batteries	Roasters
Gyratory Crushers	Compressors	Dryers
Crushing Rolls	Hoists	Smelting Furnaces
Huntington Mills	Engines	Converters
Chilian Mills	Boilers	Centrifugal Pumps
Tube Mills	Jigs	Steam Turbines

Prompt shipment on standard Machinery. Write for Bulletins on the subject which interests you.

FRASER & CHALMERS OF CANADA

4 PHILLIPS PLACE LIMITED MONTREAL, P.Q.

ASSAYERS' AND CHEMISTS' SUPPLIES

Mercury, Cyanide, Caustic Soda, Sodium Carbonate, Sodium Bicarbonate, Bone Ash, Powdered and Glass Borax, Test Lead, C.P., Litharge C.P., Litharge Commercial, Zinc Sheet and Zinc Dust, Aluminum Dust, Baker and Adamson C.P. Chemicals.

Morgan Battersea Clay Goods, Furnaces, Crucibles, Muffles, Scorifiers, Ainsworth Balances, Jena Glassware and Laboratory equipment of all kinds. Engineers, Surveyors and Draughtsman's Tools, Tapes, Books, Inks, etc.

Shelf and Heavy Hardware of all kinds.

Wood Pulleys,	Brass Valves,	Mild Steel,	Jute Ore Sacks.
Steel Pulleys,	Iron Body Valves,	Steel Plates,	Duck and Paper Concentrate Sacks,
Iron Pulleys,	All Iron Valves,	Angles,	Corrugated Iron,
Shafting,	Pipe Fittings,	Rails,	Metal Siding and Roofing,
Hangers,	Black and Galvanized Pipe,	Fish Plates,	Roofing Felts,
Pillow Blocks,	Ventilation Pipe,	Bolts and Spikes,	Building Paper,
Collars, etc.	Blowers and Fans,	Candles,	Nails, Glass, etc.
Goodyear Rubber Belting,	Tools, all kinds,	Carbide Lamps,	B & S Wall Board.
Leather Belting,	Drill Steel,	Carbide,	P. & B. Paints.
Stoves and Ranges.	Bar Iron.	Mazda Lamps,	

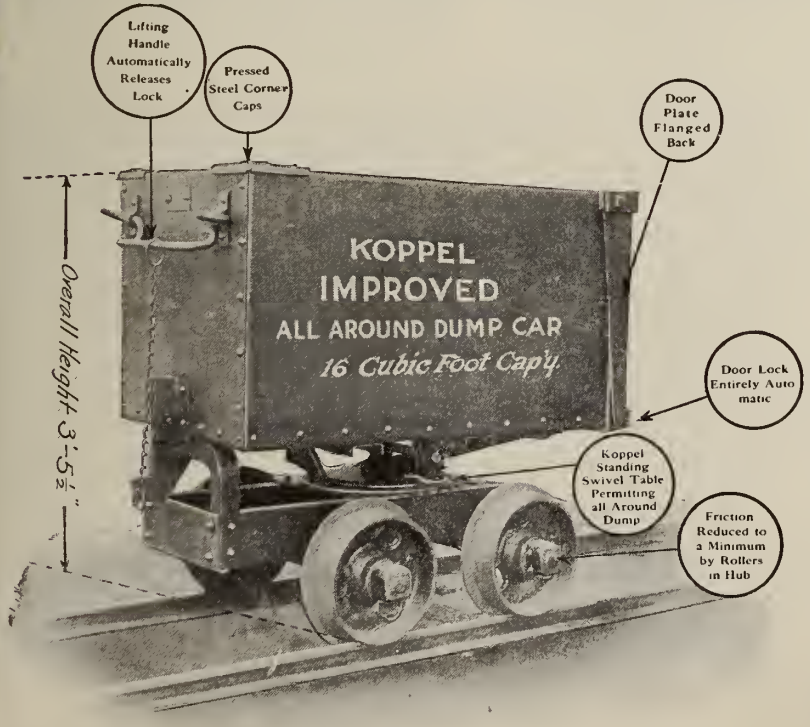
WAUGH STOPING DRILLS are leaders. Ask the man who uses them.

THE GEORGE TAYLOR HARDWARE CO. LIMITED

NEW LISKEARD (Head Office) COBALT COCHRANE

MINE TELEPHONES
Save miles of walking—save valuable time—minimize accidents. Our nearest house will tell you how Northern Electric Mine Telephones will
Increase Efficiency in Your Mine Write Us To-day
Northern Electric Company LIMITED
Montreal Halifax Toronto
Winnipeg Regina Calgary
Edmonton Vancouver Victoria

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Capy.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N.B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

HADFIELDS
LIMITED
SHEFFIELD

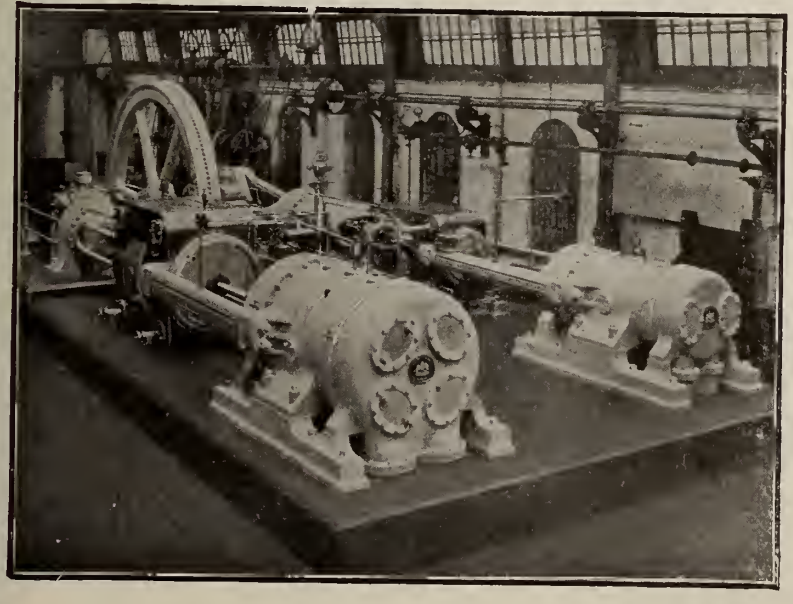
STEEL CASTINGS
of Every Description

Send for Bulletin No. 79

SOLE MAKERS
OF
HADFIELD'S PATENT
"ERA"
MANGANESE STEEL
THE SUPREME METAL
FOR WEARING PARTS

SOLE AGENTS
Montreal PEACOCK BROTHERS Vancouver

WALKER BROTHERS (WIGAN)
LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES
With Valves to Recent Patents

THE
"WALKER"
COMPRESSOR
is deservedly famed for
Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

The Canadian Bank of Commerce

PAID-UP CAPITAL, $15,000,000
RESERVE - - 13,500,000

DRAFTS ON FOREIGN COUNTRIES

Arrangements have recently been completed under which the branches of this Bank are able to issue Drafts on the principal points in the following countries.

Austria-Hungary	Fr'ch Cochin-China	Norway
Belgium	Germany	Persia
Brazil	Great Britain	Phillipine Islands
Bulgaria	Greece	Roumania
Ceylon	Holland	Russia
China	Iceland	Servia
Crete	India	Siam
Denmark	Ireland	South Africa
Egypt	Italy	Straits Settlements
Faroe Islands	Japan	Sweden
Finland	Java	Switzerland
Formosa	Manchuria	Turkey
France	Mexico	West Indies and elsewhere

No Delay in Issuing. Full Particulars on Application.

American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages*, 6x9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

Few Repairs

It is not so much how many holes a rock drill will put in per shift—but rather how long it will stay down in the mine. We absolutely guarantee that

"The Cleveland"

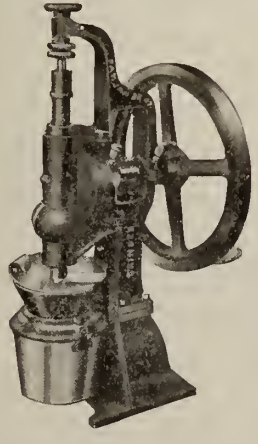
Stope Drill will not only do as much work as any drill made, but it will go longer without any repairs, takes less time to make the repairs, and gives better satisfaction all the time. And that is some guarantee.

TRY ONE

Bulletin 40-A Mailed Free.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street, TORONTO

BRAUN'S SAMPLE GRINDER



An Efficient Hand Power Laboratory Grinder

Price (Duty Paid) $65.00

Pulverizes to any fineness up to 200 mesh with one feeding.

Write for special circular.

Canadian Agents

LYMANS, LIMITED
MONTREAL

Washing Tanks
Cyanide Tanks
Settling Tanks
Pressure Tanks
Air Reservoirs
Storage Bins

Any Size
Any Style
Any Number

Bulletin No. 400

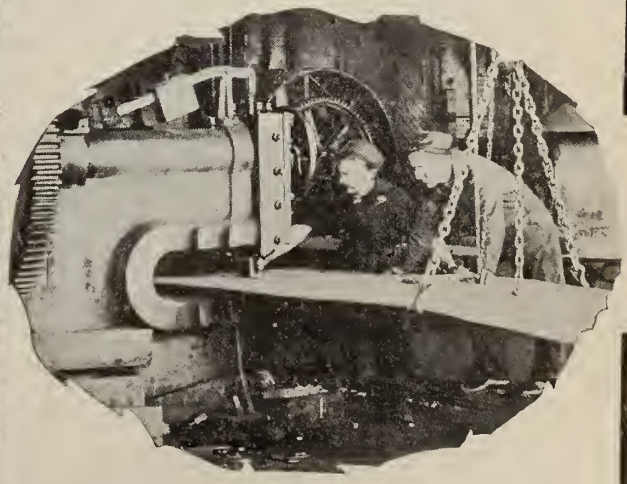
WATEROUS
RIVETTED STEEL TANKS

Most Steel Tanks are built to order, and you know what that kind of work generally costs. *Generally*—that is—not always.

In our boiler shop a separate department is kept busy building Steel Tanks. Continual experience in this work has taught us how to handle every kind of special tank job that comes along in the best way to keep down production costs.

That's why we are able to build tanks to suit your special requirements at a price that is not special.

Send your sketches to us. We will quote you prices that are attractive. Remember, we guarantee our workmanship.



The Waterous Engine Works Co., Ltd.
Brantford - Canada

GREENING'S WIRE ROPE

Our Mining Ropes are especially constructed to suit the requirements for HOISTING or HAULING.

Crucible Cast Steel
Best Plow, Acme Brand,
extra high breaking strain for deep shafts.

Regular Lay Lang's Lay

Wire Rope Fittings
Wire Rope Grease

ASK FOR OUR ROPE CATALOGUE

The
B. Greening Wire Co.
Limited

Hamilton, Ont. - Montreal, Que.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 14" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: **NEW GLASGOW, NOVA SCOTIA**

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Continuous Operation Without Attention

An abundance of oil from the reservoir is supplied continuously to all bearings. It has a simple valve gear. The side-crank design places the fly wheel or driving pulley between two bearings which are easily kept in line.

INTERNATIONAL ENGINEERING WORKS, Ltd.

WORKS AT
Amherst, N.S.

So. Framingham, Mass.

39-69

Montreal
Toronto
Edmonton
Winnipeg
Cobalt

"BEATTY HOISTS"

Clamshells, Derricks, Centrifugal Pumps, Etc.

If you need a Clamshell for any purpose, we can furnish it quickly—most likely we have it in stock.

Can also supply any standard size Hoist, with single, double or triple drums—FROM STOCK.

Let us know your requirements—we'll do the rest

M. BEATTY & SONS, LIMITED
WELLAND, - ONTARIO

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records

Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

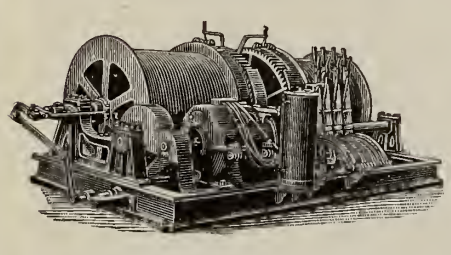
HEAD OFFICE AND FACTORY **TORONTO** BRANCH FACTORIES **WINNIPEG** AND **MONTREAL**

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

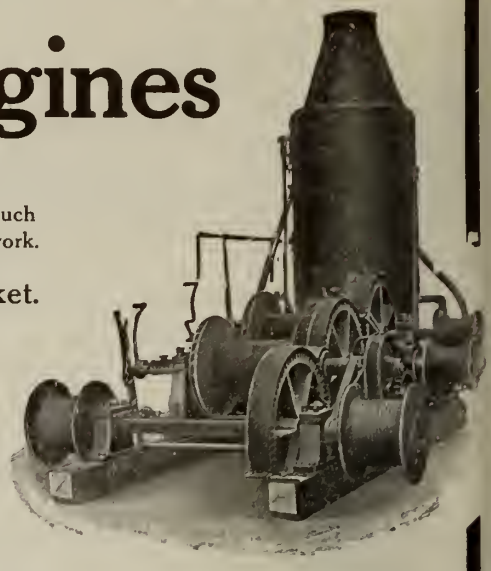


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

Office and Works: BANGOR, Pa., U.S.A.

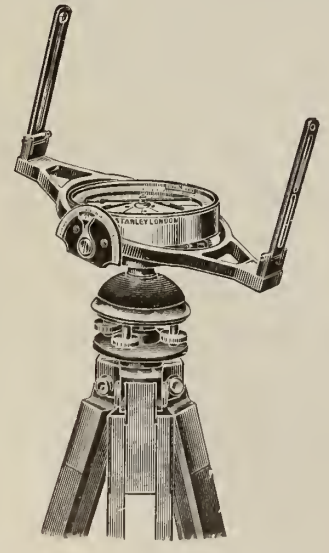
SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade **STANLEY** Mark



Improved Hedley Dial—The Cheapest and Strongest Simple Dial yet made.

The largest manufacturers of **SURVEYING and DRAWING INSTRUMENTS** in the world.

DRAWING OFFICE STATIONERY of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our "K 35" Catalogue (post and duty free) and compare our prices with those of other first-class makers.

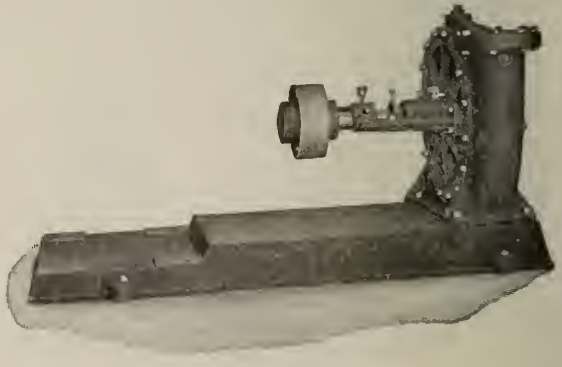
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, High Holborn, W.C.

Head Offices and Showrooms:
286, High Holborn, London, W.C., England

It always pays in the long run to buy a superior article; Therefore, when you are in the market for a new PUMP

—TRY—



The Smart Turner Machine Co.

LIMITED

Hamilton, Canada

BAGS!

Jute Cotton Duck

FOR

ASBESTOS COAL ORE

CONCENTRATES

FLOUR GRAIN FEED

PRINTING A SPECIALTY

The Canadian Bag Company Limited

Head Office: Montreal

TORONTO WINNIPEG

Amatite ROOFING

Figure It Out Yourself!

THE proposition is so simple that it hardly needs figuring. It is simply this: Most of the ready roofings on the market have a smooth surface which *requires painting every year or two.*

Amatite has a real mineral surface that *needs no painting.*

The cost is about the same.

If you buy a roofing that needs painting, you must figure on the expense of paint and the labor. If you neglect to paint it the roof soon falls apart.

Anyone who will spend a few moments investigating the proposition cannot help but decide on Amatite. Sample and booklets free on request.

THE PATERSON MFG. CO., Limited

Montreal, Toronto, Winnipeg, Vancouver, St. John, N.B., Halifax, N.S. Sydney, N.S.

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets.
Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

GOLD

Its Geological Occurrence and Geographical Distribution

By MALCOLM MACLAREN

This is an excellent treatise, carefully written by a well-known authority on gold deposits.

It is the most comprehensive work on the subject, and contains authentic descriptions of gold deposits in all parts of the world.

Accuracy and brevity are notable features.

The volume is well printed and contains 278 illustrations.

The price is $7.50.

Book Department, Canadian Mining Journal

44-46 Lombard Street, Toronto

Lindgren— # MINERAL DEPOSITS

For Sale by the

Canadian Mining Journal

44-46 Lombard St. Toronto

By WALDEMAR LINDGREN, Professor of Economic Geology, in in charge of the Department of Geology, Massachusetts Institute of Technology; Geologist, United States Geological Survey.

883 pages, 6x9, 257 illustrations, $5.00 (21s) net, postpaid

For many years Mr. Lindgren has been Geologist of the United States. Geological Survey.

In this time he has come to be generally recognized as the leading authority on ore deposits.

The publication of this work on "Mineral Deposits" has been anticipated throughout the world.

It is the first book to attempt to cover within reasonable space both metallic and non-metallic minerals, except coal and oil.

—CONTENTS—

Introduction.
Deposition of Minerals.
The Flow of Underground Waters.
The Composition of Underground Waters.
The Chemical Work of Underground Waters.
The Origin of Underground Water and its Dissolved Substances.
The Spring Deposits at the Surface.
Relations of Mineral Deposits to Mineral Springs.
Folding and Faulting.
Openings in Rocks.
Form, Structure and Texture of Mineral Deposits.
Ore Shoots.
Classification of Mineral Deposits.
Deposits Formed by Mechanical Processes of Transportation and Concentration; Detrital Deposits.
Deposits Formed by Chemical Processes of Concentration in Bodies of Surface Waters.
Deposits Formed by Evaporation of Bodies of Surface Waters.
Deposits Formed by Processes of Rock Decay and Weathering.
Deposits Formed by Concentration of Substances Contained in the Surrounding Rocks by Means of Circulating Waters.
Deposits Formed by Regional Metamorphism Formed by Zeditisation.
Deposits of Native Copper in Basic Lavas.
Lead and Zinc Deposits in Sedimentary Rocks in their Genetic Connection with Igneous Rocks.
Deposits Formed Near the Surface by Ascending Thermal Waters and in Genetic Connection with Igneous Rocks.
Deposits Formed at Intermediate Depths by Ascending Thermal Waters and in Genetic Connection with Intrusive Rocks.
Veins and Replacement Deposits Formed by Hot Ascending Waters at High Temperature and Pressure and in Genetic Connection with Intrusive Rocks.
Deposits Formed by Processes of Igneous Metamorphism.
Mineral Deposits of Pegmatite Dikes.
Mineral Deposits Formed by Concentration in Molted Magmas.
Metamorphosed Deposits.
Oxidation of Metallic Ores.
Calculation of Analysis and Representation by Diagrams

MINE RAILS

12 to 45 Pounds

PROMPT SERVICE.

H. A. DRURY CO.

LIMITED

MONTREAL and TORONTO

Are you insured against this loss?

Millions of dollars have been lost during the past winter in the manner shown in the picture, which was taken in Cleveland, O., last November.

Why not insure your company against such loss by installing your electric wires underground.

Now is the time to plan this work. *Write our nearest office to-day.*

Standard Underground Cable Co., of Canada, Limited
Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

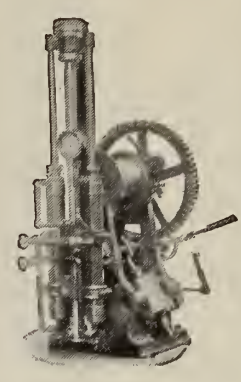
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid-Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

POSITION WANTED

As superintendent or foreman, by one who has had wide experience in Mechanical Construction, Draughting, Designing and Erecting of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc. References. Will accept small salary until value of services is demonstrated.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.

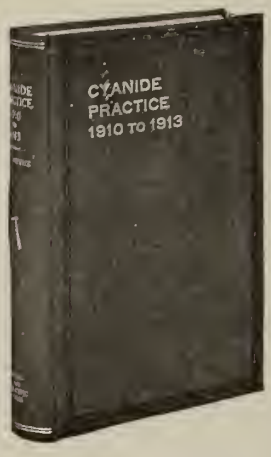
DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

CYANIDE PRACTICE
1910-1913



Edited by

M. W. von Bernewitz

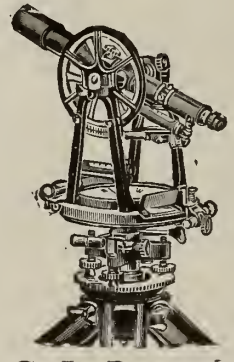
732 pages, 6x9 in.
140 illustrations

Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings:
Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto



Berger
TRANSITS AND LEVELS

Latest Designs in Instruments for Underground Surveying for all classes of work. Complete Catalog fully describing and illustrating these instruments, with a **code of 14 pages** for ordering from a distance. **A large manual giving full and concise directions** in the **care, use** and **adjustment** of instruments, is furnished with each new instrument.

C. L. Berger & Sons, Boston, Mass., U.S.A.

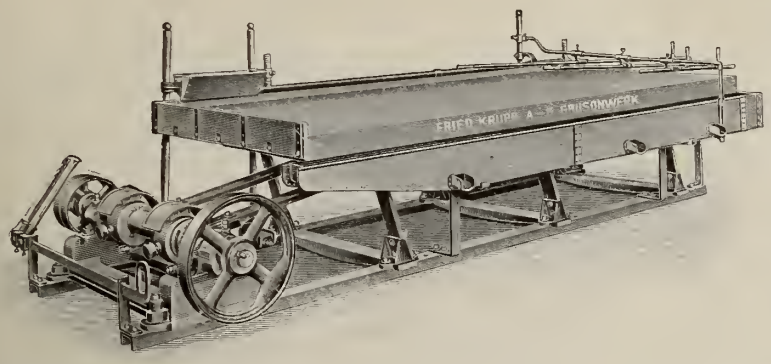
Send for Illustrated Catalog. Order Instruments by code in back of catalog.

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK



Oscillating Table

COMPLETE INSTALLATIONS
for the
TREATMENT of ORES of EVERY KIND
especially GOLD ORES

Chemical and Metallurgical Laboratories.

Large Experimental Works equipped with full sized machines for Crushing and Ore Concentration.

FRIED. KRUPP A.-G. GRUSONWERK
Magdeburg (Germany)

Canadian Representatives:
Jas. W. Pyke & Co., Limited, 232 St. James St., Montreal

KRUPP
CRUSHING, CONCENTRATING & SMELTING MACHINERY:

Amalgamating Pans	Jigs
Amalgam Presses	Mercury Traps
Ball Mills	Picking Tables
Bucket Wheels	Retorts
Bullion Furnaces	Roasting Furnaces
Chilian Mills	Rolls
Clean-up Pans	Scoop Wheels
Concentrating Tables	Screens
Conveyors	Settlers
Cyanide Plants	Slime Tables
Edge Runners	Smelting Furnaces
Electro-magnetic Ore Separators	Sorting Belts
Grizzlies	Spitzlutten
Rotary Crushers	Stamp Mills
	Stone Breakers
	Trommels
	Tube Mills

COMPRESSORS
FOR MINING WORK
LOW INITIAL COST LOW MAINTENANCE CHARGES
Manufactured by Belliss & Morcom, Ltd., England
LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.
MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produeed Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zine, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Briek, ete., $17,576,084; making its Mineral Produetion to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Provinee is strikingly exhibited in the following figures, whieh show the value of produetion for suecessive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Provinee has been even prospeeted; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Provinee are more liberal and the fees lower than those in any other Provinee in the Dominion, or any Colony in the British Empire.

Mineral loeations are granted to diseoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM
(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)
29 Broadway, New York.
Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

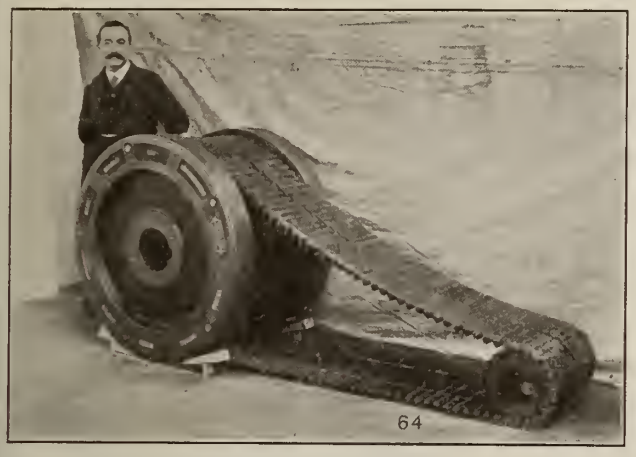
Has stood the test in Canada for Twenty years.

Manufactured by

B. K. MORTON & COMPANY
SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

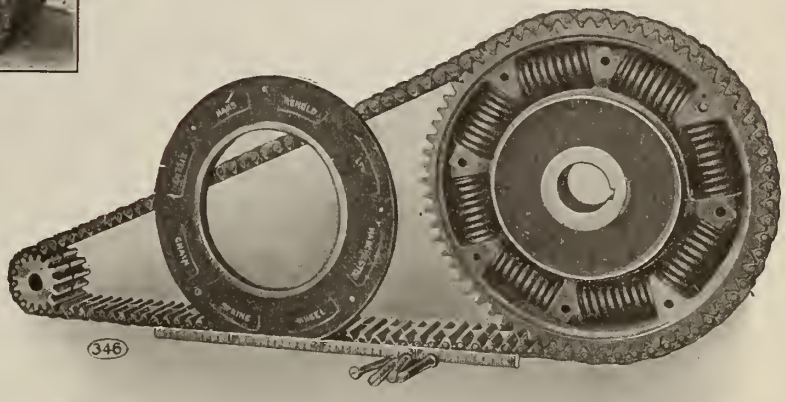


200 H.P. Renold Chain Drive from Motor to No. 9 Roots Blower. Centres 6 feet.

Renold Patent Silent Chains Driving Blowers

Effect Great Saving of Power and valuable space in a Prominent Canadian Plant.

The above cut illustrates one of four similar chain drives which replaced leather belts. Driven wheels are fitted with springs to absorb fluctuation of load.



Spring wheel, on lighter drive, with plate off, showing construction.

Jones & Glassco (Regd) Engineers

Sole Canadian Agents

49 Place D'Youville - - Montreal

Branch Office - Toronto

A Practical Success for Picking Table Service in Handling Coal, Ores, Stone, Gravel, etc.

JEFFREY DOUBLE-BEADED STEEL APRON CONVEYERS

The double beading of the flights not only stiffens the apron, but preserves its shape, and provides a close tight joint.

Furnished with or without vertical retaining ends, constructed of a series of plates lapped "shingle fashion" in the direction of the travel of the conveyer, to further insure against leakage.

Apron Sections carried on Double Strand Steel Thimble Roller Chains—especially adapted to this service.

These picking tables are built in sizes and widths to suit capacities for large or small mines. Self-contained, and may be installed in tipples already constructed.

With JEFFREY COMBINATION PICKING TABLES AND LOADING BOOMS, all Grades of Coal can be Loaded to Railroad Cars with Practically No Breakage. Write for Descriptive Bulletin No. 45.

THE JEFFREY MANUFACTURING COMPANY

Canadian Main Office and Works : MONTREAL

AFTER MONTHS OF TRIAL

Run Under Ordinary Working Conditions——

HOLMAN STEEL ROCK DRILLS

have been purchased in quantities by one of the largest Mining Companies operating in British Columbia.

QUARRY WORK WITH HOLMAN DRILLS IN BRITISH COLUMBIA

THE HIGH DRILLING SPEED,
THE LOW MAINTENANCE COST,
and
THE LOW AIR CONSUMPTION,
of the Holman Steel Rock Drill,
together with the absence of special shanks for the drill steels, were the IMPORTANT FACTORS which enabled us to secure this large installation of drills.

We Guarantee that over long periods **THE HOLMAN STEEL ROCK DRILL** will drill a greater footage at a lower cost for air and repairs than any other make of equal size.

THE DRILL YOU WILL FINALLY BUY

Write us about your drill troubles ; we can straighten them up for you.
Send for Catalogue J-51 to our nearest office.

SOLE CANADIAN SALES AGENTS

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, April 1, 1914. No. 7

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

Editorials—	Page.
Gold Deposits of Northern Ontario	217
The Classification of Igneous Rocks	219
Canadian Mining Institute	219
The Late C. R. Devlin	219
Railways and Mineral Production, by E. Jacobs	221
The Electrical Driving of Winding Engines and Rolling Mills, by C. A. Ablett and H. M. Lyons	223
The Occurrence of Gold in Ontario, by J. B. Tyrrell	230
Kirkland Lake Exploration, Limited	236
Burnside Claims, Kirkland Lake	236
The Mill and Metallurgical Practice of the Nipissing Mining Co., Ltd., (continued), by James Johnston	238
Electrical Training for Mining Engineers, by Alexander Anderson	242
The Electro-Metallurgy of Steel	244
Book Review	245
Recent Publications of the Geological Survey	245
Personal and General	246
Special Correspondence	247
Markets	252

GOLD DEPOSITS OF NORTHERN ONTARIO

In this issue we reprint from the transactions of the Institution of Mining and Metallurgy extracts from a paper by Mr. J. B. Tyrrell, entitled "The Occurrence of Gold in Ontario." With his paper are presented extracts from the discussion by Dr. J. M. Bell, Mr. A. G. Burrows, and Mr. S. J. Lett.

In view of the fact that Ontario has suddenly become a large producer of gold we may expect that much will be learned in the next few years concerning the nature of Ontario gold deposits. There are already in the literature many brief descriptions of deposits; but the recorded observations have, in many cases, not been satisfactory on account of the small amount of accurate information available. The development of profitable deposits which has been recently begun is being accompanied by systematic study which has not formerly been possible. In a few years it should be possible to write a reasonably thorough description of the Porcupine and Kirkland Lake deposits.

In the meantime, however, those who are interested in the development of the deposits can make good use of the information which has already been gathered by the many mining men who have visited the districts. The Ontario Bureau of Mines has published geological maps and reports which have been of much service. The work of Mr. A. G. Burrows, who has spent several seasons in the district for the Bureau, has been frequently favorably commented upon by those who have had to puzzle over the ores and rocks. Aside from the Government and mining company reports, however, there has been little of the vast amount of information gathered placed on record. Each investigator who has gone into the district with his eyes open has found many reasons for concluding that there is very little yet known concerning the deposits. Each learns a little; but hesitates to risk exposure of what he has learned.

In his paper Mr. Tyrrell has broken the ice. He has drawn some conclusions from his observations and stated them. Dr. J. M. Bell says politely that Mr. Tyrrell is wrong in asserting that the Kirkland Lake deposits are typical of Ontario gold deposits, and proceeds to prove it. Mr. Tyrrell replies that Dr. Bell is mistaken, and presents some information to substantiate his statements. Mr. Burrows gives some information from which one might conclude that his views and Mr. Tyrrell's concerning the relative age of the conglomerate and porphyry in the Kirkland Lake district are diametrically opposite.

It may seem surprising that such difference of opinion exists among those who have had frequent oppor-

tunity to study the geological characteristics of the deposits. Anyone who reads the paper and discussion must conclude that one or other is incorrect in his statements or illogical in his conclusions. Those who have made a special study of the geology of pre-Cambrian ore deposits will, however, not be as much surprised as others. It seems but another illustration of the danger of applying to a whole district conclusions drawn from the study of widely separated outcrops.

Mr. Tyrrell takes the Swastika district as a type to illustrate the occurrence of gold in Northern Ontario. To this we raise the objection that the Swastika district is not typical and that moreover there is considerable variety in the narrow limits of the Swastika district itself.

Compare the Tough-Oakes deposit with the Hollinger. Are they similar? In a few respects, yes; but in most respects, decidedly no.

At the Hollinger there is a system of large quartz veins standing nearly vertical and parallel to one another and enclosed partly in a massive rock whose chief constituents are quartz, carbonates, and sericite, and partly in greenstone containing these minerals. The veins are several feet in thickness and composed largely of white quartz with a little pyrite and small quantities of several secondary minerals. The gold is in the form of native gold. The ore is a remarkably simple, easily-treated, pyritic, gold quartz. The country rock of the main vein was probably originally a rather siliceous porphyry.

At the Tough-Oakes the ore and enclosing rock are of very different character. The vein matter exposed will average only a few inches in thickness. The enclosing rock is a conglomerate. The vein where opened up is but a few feet from the contact with a mass of feldspar-porphyry. The ore contains tellurides as well as native gold, and is frequently accompanied by a black substance which is known to be partly molybdenite. Minute crystals of pyrite are very abundant. The rock is much fractured, and there are numerous seams of distinctly secondary quartz. The conglomerate underlies the porphyry and the vein dips towards the contact.

Dr. J. M. Bell, in discussing Mr. Tyrrell's paper, suggests that the Porcupine gold deposits are more typical of others in Ontario. He goes on to say, however, that both at the Dome and Hollinger the gold occurs in the schist as well as in the quartz. There is some gold in the schist at both mines; but it has been distinctly pointed out by Mr. P. A. Robbins that most of the gold at the Hollinger occurs in the quartz and that the portions of the schist which contain much gold are characterized by quartz veinlets. Dr. Bell's statement is true enough; but it does not make clear the fact that most of the gold is in quartz.

Mr. Tyrrell and those who have discussed his paper do not give a very satisfactory account of the black substance which is so characteristic of the Tough-Oakes deposits. This is probably because of the fact that it occurs commonly as a thin film made of an aggregate of minute particles which cannot readily be separated for examination. Mr. C. A. Foster had some of this material analyzed and it was found to be partly molybdenite. Some of it contains no molybdenum. It would be interesting if those who have had analyses made would publish them. Apparently it is a mixture of minerals. In an article published in our July 15, 1913, issue we called the material graphite. Mr. Foster having found some of it to be molybdenite the interest in determining the nature of the substance seems to have dropped. It is to be hoped that some chemist will be induced to make an investigation of the substance. In the meantime we can only refer to it as molybdenite, knowing that to be one of the minerals present.

Another feature of the Kirkland Lake deposits which should prove interesting to the chemist is the presence of tellurides. A few qualitative and a very few quantitative tests have been made to determine the character of these minerals. The information so far available concerning the tellurides is anything but satisfactory.

Mr. S. J. Lett has asked whether the gold at the Tough-Oakes is commonly associated with secondary quartz, calcite and sericite. The answer is yes, so far as visible gold is concerned. The Tough-Oakes deposit shows much more evidence of secondary changes in the vein matter than do the Porcupine deposits. In places coarse gold is abundant on the fractured surfaces.

Mr. Lett asks what the sericite was derived from if the feldspars are soda-lime feldspars. The answer is that there is potash in the rocks and that sericite can be, and often is, formed in other ways than by the simple decomposition of feldspars. Moreover, it is a distinct characteristic of most Northern Ontario gold deposits that the gold quartz is enclosed by altered rock of which quartz, carbonates, and sericite are common constituents. This is the case whether the enclosed rock is siliceous or basic, igneous or sedimentary. The significance of this feature has already been pointed out in a paper on the origin of the Porcupine gold deposits.

Mr. Lett quotes Dr. Baelz as stating that the gold-bearing magma is directly connected with great granite intrusions. That is a remarkable discovery, but without any argument on which to base the statement, the conclusion doesn't seem to have any great value. What information did Dr. Baelz hope to convey by such a statement?

Mr. Tyrrell, in replying to Dr. Bell, states that the Kirkland Lake and Porcupine deposits are to be regarded as similar because they are "associated with porphyries rich in soda-lime feldspar." But is that conclusion justified by the facts, and is it an important characteristic even if true? Most porphyries are rich in soda-lime feldspars, and it is not remarkable that many of those associated with the gold deposits should be. Many of them are. Some, including those at the Tough-Oakes and Teck-Hughes, are rich in alkali feldspars. Possibly a continuation of the study which Mr. Tyrrell has undertaken will show that a narrower limit may be set on the variety of rocks which are to be con-

sidered as favorable formations for gold in Ontario. At present there is no very good reason for discriminating between the porphyries in conducting explorations. Gray feldspar porphyries of several varieties are common in the gold fields. Any of them, and the rocks around them, are worthy of close examination for gold quartz veins.

Mr. Burrows seems to be of the opinion that the porphyries are intrusive into the conglomerate. Mr. Tyrrell's description leaves the impression that he thinks the porphyries older. It would be well if a more definite statement were made as to the particular rocks being described and as to the evidence from which conclusions as to relative age were derived.

THE CLASSIFICATION OF IGNEOUS ROCKS

The publication of the very interesting volume on The Igneous Rocks, by Dr. R. A. Daly, brings up again the question of classification. For a number of years the readers of American descriptions of rocks, especially descriptions written by members of the U. S. Geological Survey, have been annoyed by the persistent use of a classification based on chemical analyses rather than on the more easily determined characteristics of rocks.

In the American quantitative classification, as it is called, the most easily determined features are made subordinate to chemical analyses and certain assumptions deduced from the chemical analyses. A great list of new names was invented and students in the colleges were required to learn the new system.

For some time evidently it has been considered quite the proper thing to avoid the use of the time-honored classification based on mineral composition. Even some of our Canadian geologists seem to consider their descriptions of rocks incomplete without the use of a few of the new terms, a table of chemical analyses of some other rocks, and a few mathematical calculations based upon more or less unfounded assumptions.

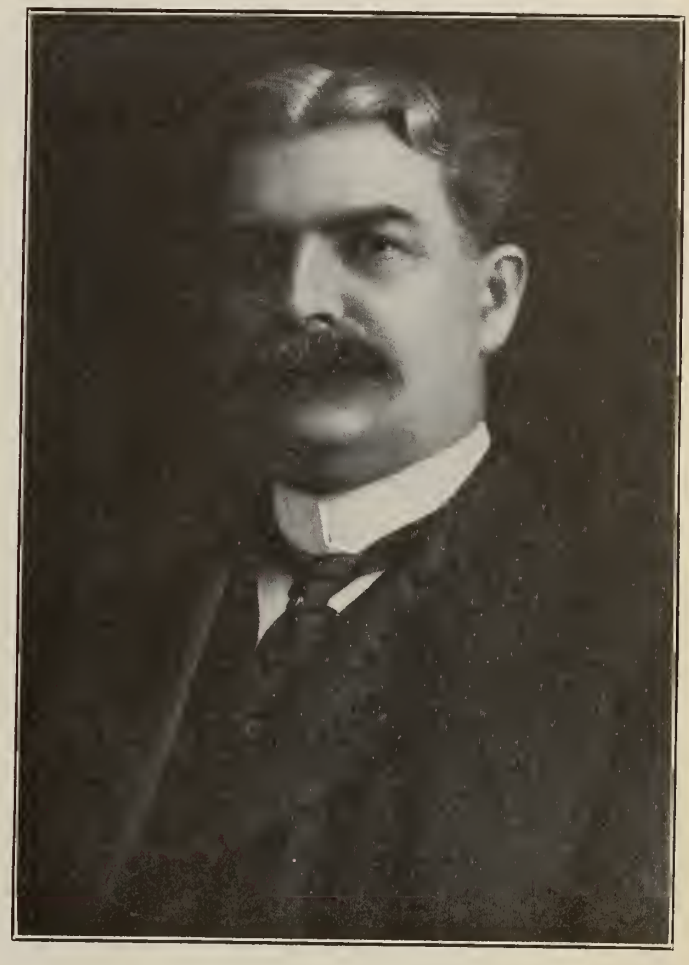
It is very refreshing to find, therefore, that Dr. Daly makes a stand in favor of the simpler classification and shows a fondness for such old terms as granite, diorite and gabbro, and a lack of enthusiasm over norms and rangs.

CANADIAN MINING INSTITUTE

The new officers are planning a campaign to increase the membership of the Canadian Mining Institute. As pointed out by President Lindsey, a larger membership would make it possible to publish a bulletin at regular intervals, possibly monthly, instead of a few times a year, as at present. The regular publication would give those who find it impossible to attend the meetings of the Institute a more substantial return for their fees and keep them better posted as to what the Institute is accomplishing. It is, therefore, in the interest of every member that the membership should be larger.

THE LATE MINISTER OF COLONIZATION AND MINES OF THE PROVINCE OF QUEBEC.

On the first of March, the Honourable Charles Ramsay Devlin passed away at his father's residence, in Aylmer East, P.Q., at the age of 55. He succumbed after a long, strenuous fight of eighteen months against a well-nigh inexorable malady, Bright's disease. That the fight was courageous, and that the spirit never flinched, will be



The late C. R. DEVLIN

realized by the members of the International Geological Congress who were present at the banquet in the Armouries of Toronto on August 13th, 1913. At the time that he made his address, answering on behalf of the Province of Quebec, to the toast of "The Dominion and the Provinces," Mr. Devlin was practically a doomed man, and he knew it. Yet there was no inkling of this in his brilliant allocation, given in a perfect, faultless French, eloquently delivered, with the slight suspicion of foreign accent, which gave to his speech an added charm. His attendance at this banquet, to which he had come against his doctor's orders, was his last appearance at a public function.

Charles Ramsay Devlin was born in Aylmer in 1858. After sound classical studies at the Ottawa College and at Laval University of Quebec, he first entered business, which he soon forsook to take up journalism and politics. He was eminently fitted for this. His education, his surroundings, had given him an additional French individuality, and he was equally liked by Irish, French and English-Canadians. From the start he won brilliant successes in his newly chosen field. His command of language, his warm, eloquent delivery, and his personality made Devlin one of the most popular speakers of

the Liberal party. In 1891, he was elected to the House of Commons, as member for Wright County, which seat he retained until 1897, when he was appointed Canadian representative in Ireland. He resigned this position in 1903 to contest the County of Galway for the British House of Commons. He represented this constituency until 1906, when he returned to Canada, and, soon afterwards, in 1907, was called to the Gouin Cabinet, as Minister of Colonization, Mines and Fisheries, which portfolio he retained until his death.

His demise leaves a great void in the Provincial Cabinet. He had proved himself a good administrator. The remodelling of the Quebec Mining Laws has been one of his chief works, he always took a keen interest in the mining industry and its development. He was a good friend of the Canadian Mining Institute.

His personality was of the most lovable and estimable nature. Warm-hearted, of strong convictions, of an integrity and honesty of purpose above the shadow of suspicion, Charles Devlin had adversaries, as all strong characters must have, but it may truly be said that he had no enemies.

THE COBALT COMBINE.

London, March 11.—Official details of the proposed amalgamation of four of the Cobalt mining companies, regarding which we were able to give some advance information in yesterday's issue, are now published and will doubtless be studied with interest by the British shareholders concerned. The scheme is a complicated one. The mining properties are held by Canadian companies, in three of which English companies with similar titles hold a controlling interest. These three are the Cobalt Townsite, the Cobalt Lake, and the Townsite Extension. The fourth property included in the deal is the City of Cobalt Mining Company, a Canadian concern, the controlling interest in which is held by the Cossack Exploration Company, another Canadian enterprise. A new Canadian company is to be formed with a capital of $2,075,000 in shares of $1 each to purchase the mining properties from the companies in which they are now vested, and a new English company—which will control the Canadian amalgamated company—is to be incorporated with a capital of approximately £1.600,000 in £1 shares. The Cobalt Townsite and Cobalt Lake (English companies) will receive respectively 600.000 and 509.580 shares in the new English company, 60.000 will go to the Canadian Extension Company and 359.538 will be allotted to the Cossack Company. The valuations adopted as a basis of the scheme are set out in the circular as follows:—

Cobalt Lake	£600,000
Cobalt Townsite	600,000
City of Cobalt	400,000
Townsite Extension Property	60,000

It is not clear why the Cobalt Lake should be valued on the same basis as the Cobalt Townsite, nor why the City of Cobalt should be considered worth two-thirds the valuation of those two undertakings. Evidently the market valuations have not been taken into account, for at current prices that of the Cobalt Lake works out at approximately £446,000 and that of the Townsite at £537,000. The last price we heard of for City of Cobalt shares was 32½ cents, which would make the market capitalization of this concern just about £136,000. Apparently this divergence accounts for the criticism of the scheme we have already heard, to the effect that the terms favor the holders of City of Cobalt and Lake shares, as against those interested in the Townsite, although the last-named concern will evidently be expected to provide the largest proportion of the amalgamated concern's earnings, at any rate so far as the early future is concerned. On the face of it the scheme looks rather like an attempt to work off the City of Cobalt, for which a market has not yet been found in London; anyway, the proposals need careful consideration, and it would, we think, have been better if more time had been given for the purpose than is indicated by the calling of the Townsite meeting for the 18th instant.—Financial Times.

HOLLINGER.

The statement of the Hollinger Mines for the second four-week period of 1914 shows gross profits amounting to $111,679.60, with current assets of $358,980.42, and estimated gold reserves of $228,757.38. The surplus at February 25 stood at $721,805.68, a net increase of $33,-342.88 since the beginning of the year. Capital expenditures during the period amounted to $13,317.12, less $2,777.70 received for dwellings sold to employes.

Working costs were unusually high during the period, as, according to the assistant manager's report, an accident to the plant of the power company supplying the mine reduced the running time 25 per cent. in the mill, and 15 per cent. in the mine. The costs totalled $5,518 per ton of ore milled, including $2,373 for mining, and $1,513 for milling. A total of 9,681 tons of ore was hoisted, of an average value of $17.50 a ton, and 1,672 tons were hoisted of waste rock. In the mill, which ran 72 per cent. of the possible running time, 10,042 tons were treated, including 239 tons on account of the Acme Gold Mines. Approximate extraction was 97.4 per cent.

During the period No. 8 vein was cut by a crosscut on the 300-foot level, and No. 4 vein was located by diamond drill on the 425-foot level. The main shaft was sunk to 425 feet, and equipment commenced. Development work amounted to 635 feet, and diamond drill exploration to 522 feet.

JUPITER.

Toronto, March 24.—A special meeting of the Jupiter shareholders has been called for Wednesday, April 8, in Montreal, to confirm the deal with the McKinley-Darragh Mines for the financing of the Jupiter. An official circular giving the details of the deal differs in some respects from previous summaries:

The deal as officially explained will be as follows:

A six months' option to buy a half interest in the Jupiter, in exchange for which the McKinley-Darragh agrees to spend $30,000 in developing the Jupiter during that period. If the McKinley-Darragh exercises its option, it agrees in addition to pay off the bonded debt of the Jupiter, $50,000, and to pay into a new company to be formed to take over the Jupiter a further sum of $40 000 for further development. The McKinley-Darragh will also supply further funds should they be deemed necessary.

Subsequently a $2,500,000 corporation is to be formed, to which the Jupiter mine is to be conveyed. Of the issued shares of the new company, the McKinley is to receive an amount equal to 50 per cent. of the outstanding shares of the Jupiter, and a similar amount is to go to Jupiter mines shareholders. The remaining shares will be left in the treasury of the new company. It will thus be seen that one of the features of the deal is that the new company's capitalization will be $2,-500,000, an increase of $500,000 over Jupiter's present capitalization.

RAILWAYS AND MINERAL PRODUCTION*

By E. Jacobs.

At a meeting of the Western Branch of the Canadian Mining Institute, Mr. Alexander Sharp (in by-gone years a coal mine superintendent on Vancouver Island, but for several recent years mining engineer to Mr. P. Burns, who has extensive mining interests), directed attention to the very striking effect the construction of railways in Canada has had upon the mineral production of the Dominion. Going back to the days of construction of the Canadian Pacific Transcontinental Railway, he quoted from Dominion official statistics the value of the mineral production for the calendar year 1886, namely, $10,221,235, and with that relatively small amount he compared the total for 1912—$135,048,296.

Mount Robson, the monarch of the Canadian Rockies. On the line of the Grand Trunk Pacific.

The total value of the mineral production of Canada for the period of twenty-seven years, 1886-1912, is on official record as having been $1,371,502,110; official fig-

*Written for the Daily Colonist.

ures for 1913 are not yet available, but estimating last year's production at only $140,000,000—a very low estimate, I believe—this will give a total for all years appearing in the official statistical tables of approximately $1,511,502,000.

At Mr. Sharp's suggestion I gave the meeting above mentioned some comparative figures showing the large increase in British Columbia's mineral production since its present producing districts were made accessible by the construction of railways. For all years up to 1893, inclusive, the total value on record was $84,678,482; for ten years, 1894-1903, it was $122,546,010; for ten years, 1904-1913 (allowing $30,000,000 as the value of last year's production it was $252,913,030.

Incidentally it may be mentioned that the total value of the production of Rossland mines in 1894 was $75,-510; during twenty years to the end of 1913 the grand total has attained to between $55,000,000 and $60,000,000. Figures printed by the Consolidated Mining and Smelting Company, Ltd., in its last annual report—to September 30, 1913—show the gross value of ore produced from the Centre Star group of mines, at Rossland, as $26,489,615, and from the Le Roi, $22,462,640, together $48,952255; figures of value for East Kootenay mines are: St. Eugene, $10,626,608, and Sullivan group, $4,364,805.

Last month is was announced in the press that the output of ore from the Granby Company's mines at Phoenix had just passed the 10,000,000 ton mark; that quantity represents a gross value that may be approximated at $40,000,000 and still leave a margin not included. Then there are the big mines of the British Columbia Copper Co. and the New Dominion Copper Co., the value of the output of which, added to that of the Granby Co., and others, brings the total for Boundary district up to about $60,000,000. And practically none of this vast natural wealth was available for utilization until after the completion of the Columbia & Western Railway in 1900, although the ore deposits had been prospected, more or less, for ten years previously.

The coal mines of the Crowsnest country, South-east Kootenay, might also be cited, but for still more striking evidence of the great transformation made in the utilization of natural resources let us look at Ontario, which has of late years wrested from British Columbia its previously enjoyed pride of place as the "Mineral Province of Canada." In 1904, the year Cobalt mines commenced to produce silver, which metal was discovered there as a result of making a rock-cut in the course of construction of the Government-owned T. & N. O. Ry., the value of the silver output was $118,376; in 1912, official figures show it to have been $17,772,352, while the quantity of silver produced in 1913 was larger than in 1912. Again, take Ontario's gold output. In 1911, it was $42,625; in 1912, after the T. &. N. O. Railway had been extended to the Porcupine district, it was $1,788,-596; for 1913, the estimate of the Deputy Minister of Mines for Ontario is $4,300,000, practically all from the country opened by the T. & N. O. Railway, Ontario's total mineral production in 1904, the year production was commenced at Cobalt, was valued at $12,-582,843; for 1912, it was $51,985,876; for 1913, an estimate of $55,000,000 does not seem too high—a fourfold increase in less than ten years, due largely, if not altogether, to railway construction.

The late Dr. George M. Dawson, then assistant director of the Geological Survey of Canada, more than twenty years ago read before the Royal Colonial Institute a paper on "The Mineral Wealth of British Columbia," in the course of which he observed: "I wish to draw attention to one or two ruling features of the actual situation which are too important to be left without mention: The Cordilleran belt, or Rocky Mountain region, of North America, has, whenever it has been adequately examined, proved to be rich in the precious metals as well as in other ores. This has been the case in Mexico and in the Western States of the American Union. . . . . Placer gold mining has often been continued for years and then abandoned, long before the gold and silver-bearing veins in the same tract of country have been discovered and developed. This later and more permanent phase of mining has followed the construction of roads and railways, and the series of conditions thus outlined are repeating themselves in British Columbia to-day. The Province includes a length of more than 700 miles of the Cordilleran region."

Earlier in his paper, Dr. Dawson had remarked: "Although British Columbia possesses valuable fisheries and remarkable resources in its forests, besides important tracts of arable and pasture land, much of its prosperity must depend on the development of its mineral wealth, which is the compensation afforded by Nature for the generally rugged character of a large part of its surface."

Just a few more figures in conclusion. Eleven years ago, Mr. Bernard MacDonald, widely known as a leading mining engineer, read before the Canadian Mining Institute a paper entitled, "Mining Possibilities of the Canadian Rockies." In that he showed that in Mexico the Rocky Mountains had yielded of the precious metals alone a production of $5,500,000,000 over a length of 1,700 miles, or an average of $3,235,300 a mile; in the United States, $4,500,000,000, or $3,460,000 per mile along a length of 1,300 miles, while in Canada the total had reached only $166,000,000," of course with a correspondingly small amount per mile. Later, Mr. MacDonald added: "It is fair to assume that the Rockies in Canada will yield a quantity of the precious metals equal to that produced by them in American or Mexican territory—mile for mile of their length—when equally developed." Corresponding figures brought up to date would, of course, be much more impressive, but let us take the United States amount per mile as it stood in 1902 and apply it to British Columbia's 800 miles of the Cordilleras—$3,460,000 per mile for 800 miles would equal $2,768,000,000. Why, only one-tenth of the production up to 1902 (which leaves out of account the very large total for the eleven years that have since elapsed) would be $276,800,000, or considerably more than one-half of the total value of the mineral production of British Columbia in all years since Hudson Bay men commenced to mine coal more than sixty years ago. And then there is the big country north and north-east of British Columbia to keep in mind as well. But all this potential wealth will lie dormant until it shall be made accessible by the construction of railways.

ALASKA-YUKON RAILWAY.

"I believe the time has now come for the building of a railroad through Northern British Columbia to the Yukon and Alaska, and I may say that the authorities at Washington and Ottawa have both gone so far as to heartily endorse some project of co-operation in the building of this line."

In these words, according to the Daily Colonist, Sir Richard McBride, at a session of the Legislature discussed the possibilities of the early evolution of a scheme which he is known to have had closely at heart for many months and opened up a vista of possibilities for the extension of the railroad policy of the Province that is bound to excite a widespread interest on this continent and in Europe.

THE ELECTRICAL DRIVING OF WINDING ENGINES AND ROLLING MILLS*

By C. Antony Ablett, A.M.Inst.C.E., and H.M. Lyons, A.M.I.E.E .

The use of electrical machinery for driving hoisting engines in mines and reversing rolling mill plants in steel works is comparatively recent, the first winders of importance having been introduced in 1902, and the first electrically driven reversing rolling mill being installed in 1906, though non-reversing rolling mills were driven electrically some eight or ten years earlier.

The developments along these lines have been extremely rapid, as is shown by the fact that at the present time about one thousand large winding engines and nearly sixty reversing rolling mills are being driven electrically, and still greater developments may be expected in the future.

Under these circumstances a paper dealing with the modern aspects of the subject and giving the results of the experience obtained in the past would appear desirable.

The earlier winding engines were extravagant in power and had the disadvantage of drawing very heavily upon the source of electrical supply at the moment of starting. It was, therefore, impossible to use them on systems where the supply of current was limited, and even on comparatively large plants their use resulted in serious interference with other machinery. These disadvantages were, however, practically done away with

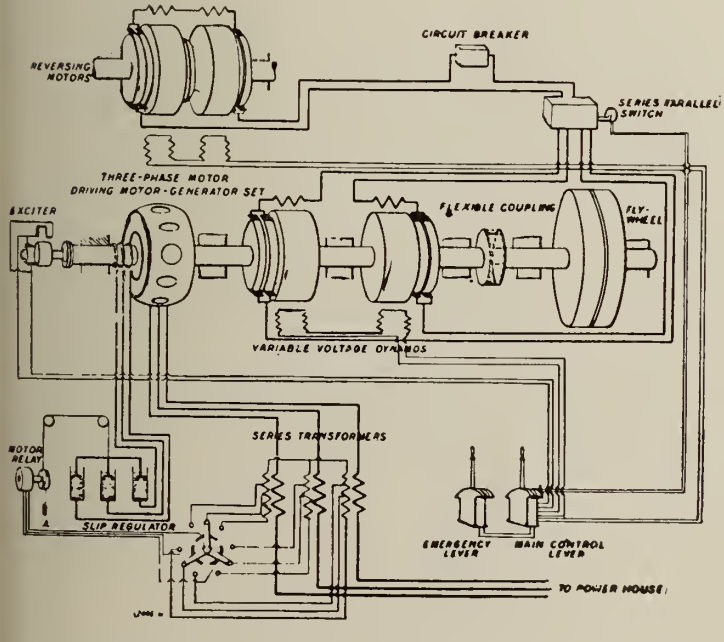


Fig. 1.—Diagrammatic view of Ilgner system of driving winding engines or reversing rolling mills.

when the Ward Leonard system and Ilgner's adoption of the flywheel to this system were introduced, but the last few years have seen greater improvements in the Ward Leonard and the Ilgner system.

The present paper will deal chiefly with the developments of these systems by the various Siemens Companies, who have installed about half the total plants in existence, and with whom the authors have the honor to be associated.

Ward Leonard System.

A short description of the so-called Ward Leonard System, illustrated in Fig. 1, is desirable as an introduction.

In this system a direct current motor is used to drive the winding engine or rolling mill, the motor being supplied with power from a direct current dynamo, and the essential feature of this system is that the voltage supplied to the motor, and consequently the speed of the motor, is controlled by controlling the field current of the generator, instead of by varying the resistance in the armature circuit of the motor.

Thus, as the field current of the generator is increased from nothing to a maximum, the motor speeds up from standstill to full speed, and if the field current of the generator is reversed, the motor reverses its direction of rotation.

This system enables a very exact control of the speed to be obtained, because the speed of the motor is practically proportional to the strength of the generator field, whatever the load on the motor may be, while with any control system where resistances are inserted into the armature circuit of the motor, the speed would vary within very wide limits with a change of load, rendering the exact speed control quite impossible.

The control of the dynamo field involves scarcely any waste of electrical power, but where resistances are inserted into the armature circuit the loss of power may be, and usually is, very great.

The field currents of the generator are small, so that the control mechanism is small, compact and very easy to handle, the armature currents are perhaps fifty times as great, so that any control mechanism which varies the resistance of the armature circuits is large, clumsy and difficult to handle, in fact a complicated relay system is often necessary to enable it to be handled at all.

The dynamo used to supply the motor in the Ward Leonard system is usually driven by a motor supplied from the available power circuit, forming a motor generator set, and this motor may be either direct current or three-phase, according to the power available. The dynamo may be and sometimes is driven by an engine, water turbine or other prime mover, if this happens to be more convenient.

Application of Ward Leonard System to Winding Engines and Hoists.

Speed Control.—The main control lever for operating the winding engine is coupled to the regulating resistance in the field circuit of the generator, so that when this lever is in the mid position there is no current in the generator field. As the lever is moved in one direction the generator field current increases, and as it is moved in the other direction, the generator field current is also increased, but in opposite sense.

From what has been said in the introductory remarks it will be seen that when the lever is in the mid position, the winding engine is at a standstill, and that it starts and speeds up as the lever is moved from the mid position in one direction, while if the lever is moved from the mid position the other way the winding engine

*Authors' abstract of a paper read at a mining section meeting of the Canadian Society of Civil Engineers, March 12, 1914, and at the annual meeting of the Canadian Mining Institute, March 4-6, 1914.

increases in speed in the other direction, and that the speed of the winding engine is practically proportional to the displacement of the lever from the mid position, and is not affected by the weight of material being hoisted.

The driver has not absolute control over the speed, for two cams are provided on the depth indicator, one for

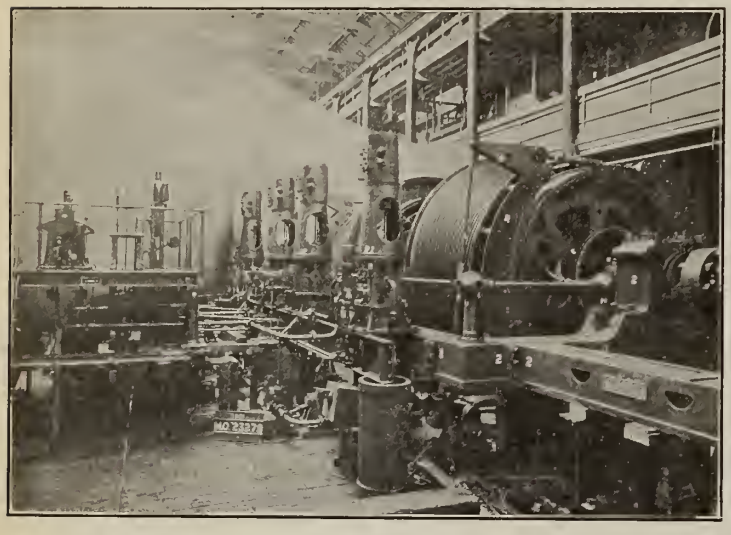


Fig. 5.—Conical Drum Ward Leonard winder, at the Canadian Collieries Company's Cumberland Colliery, showing brake gear and control levers. Depth, 1,000 ft.; nett load per wind, 3½ tons.

each cage, which operates levers coupled to the control lever in such a way as to prevent the cages being accelerated at too rapid a rate, and to slow up the winding engine at the proper point so that the bank is approached at a crawling speed.

Provided that these limits set by the cams are not exceeded the speed of the wind is entirely within the driver's control.

The depth indicator and the cams are positively driven from the drum of the winding engine and the cams are so geared that they make less than one revolution per wind.

Use of Flywheel.—Fig. 6 shows the typical horse power diagram for a winding engine. The inertia of the drums, cages, head sheaves, material wound and the ropes, which altogether weigh about 60 tons in this particular case, necessitates a horse power at the end of the acceleration period of each wind of 1865, which is about three and a half times the average power demand of the winding engine, in this case 524 horse power, and it is found that the maximum acceleration peak is usually between three and four times greater than the average demand.

The consumption of energy for this Ward Leonard control rises gradually during the starting period, and the maximum is only reached at the end of the time of acceleration, i. e. from ten to fifteen seconds after the start, because the speed of the winding motor is increased while it is giving the requisite turning moment by increasing the field of the generator, and consequently there is no loss of power in starting.

Since this acceleration peak is of short duration and only comes on gradually, it is possible to supply Ward Leonard winders from power stations of comparatively small total output, provided that the machines in the power station have a sufficient overload capacity to maintain their speed during peak loads, as is usually the case with steam turbo generators where the generators are provided with modern voltage regulators.

Where, however, this is not the case, and the acceleration peaks of the winding engine are large compared with the average demand on the power station, or where the winder is supplied through a long transmission line from a distant power station, it is sometimes necessary to couple a flywheel to the motor generator set.

This is the Ilgner system, so-called after the engineer who first used it in practice.

Fig. 7. illustrates the effect of the flywheel in equalizing the load taken by the winder, where it will be seen that the current taken by the winding motor varies between + 1900, and — 1000 amperes, while the current taken from the supply system is maintained practically constant at 400 amperes, the maximum voltage supplied to the winding engine and the supply voltage being the same.

The following example will give an idea of the power taken by the Ilgner system under practical working conditions with a winding engine arranged to wind 240 tons per hour from a depth of 1,960 feet, making as a maximum 44½ winds per hour, where the flywheel is used whenever the full output is being wound at the full speed but where a lesser output is being wound at reduced speed, so that the acceleration peaks become less serious, the flywheel is uncoupled to save power.

These results are conveniently expressed in terms of the kilowatts taken by the electric winding engine plant per shaft horse power.

	Output in tons per hour.	Kilowatt per Shaft horse power.
With flywheel	240	1.49
With flywheel	160	1.60
With flywheel	108	1.77
Without flywheel	160	1.35
Without flywheel	108	1.48

It will thus be seen that when working the winding engine on the Ilgner system there is an increased loss of power of from 16 to 17%, as compared with the Ward Leonard system, and naturally with the latter

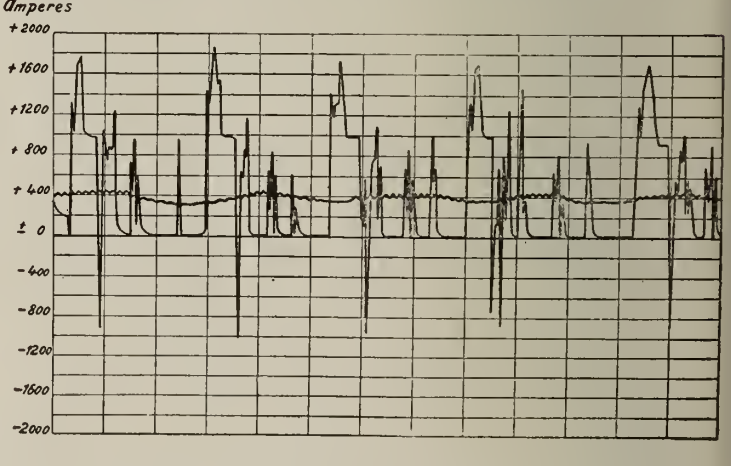


Fig. 7.—Diagram showing the equalizing effect of the flywheel on Ilgner's adaption of the Ward Leonard system. The wavey line at about 400 amperes is the current taken from the supply system. The curve which shows the great variations represents the current taken by the winding engine.

where the flywheel is uncoupled the resistances are cut out of the rotor circuit of the three-phase motor to avoid loss of power.

To avoid misunderstanding of the above results, it should be specially pointed out that shaft horse power

is taken to mean the actual work done in raising the load, i.e., if the actual weight of coal or ore, expressed in lbs., which is raised per minute is multiplied by the depth of the shaft in feet, and divided by 33,000, the shaft horse power is obtained. The shaft horse power thus does not include the mechanical friction of the winding engine, the sheaves, the guides or the rope losses, and the figure of the kilowatts divided by the shaft horse power brings in the mechanical efficiency, as well as the electrical.

Details of Ilgner System.—Of recent years the capital cost of Ilgner plants has been greatly reduced, owing to the adoption of higher speed for the motor generator sets and to the improvements in the manufacture of such flywheels, which enable them to run at very high peripheral speeds compared with those used in the earlier winding engines.

For example, the provision of flywheel capacity to equalize peak loads of 60,000 horse power seconds, in the early days of Ilgner winding, where peripheral speeds of 15,000 feet per minute were used, would require two flywheels of a total weight of about 80 tons, the friction and windage loss of which would be abou' 150 horse power. Under modern conditions where the regular peripheral speeds are 27,000 and 30,000 feet per minute a single flywheel of 22 tons weight would be used, instead of the two flywheels having a total weight of 80 tons, and the friction and windage losses would not exceed 100 horse power.

The Ilgner system was used on practically all the early European winding engines, but as at the present day power stations are being installed of much greater capacity than those of a few years ago, and high speed

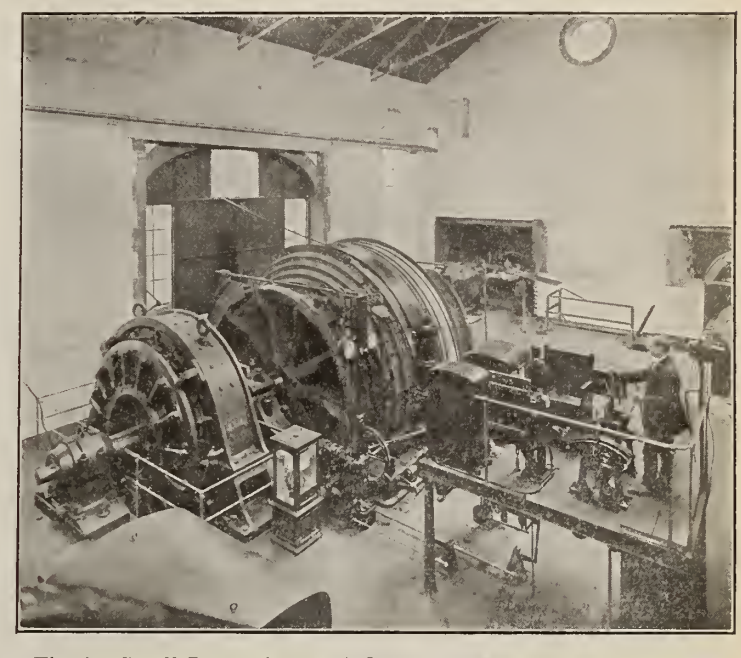


Fig. 9.—Scroll Drum Ilgner winder at Markham Steam Coal Co.'s Holly Bush Colliery, showing control gear, brake gear, depth indicator, and cams.

turbo generators of large overload capacity are being adopted, the Ward Leonard system at the present time is being used to a much greater extent than the Ilgner system for winding engine work.

Generally speaking, the Ilgner system of winding may be preferable to the Ward Leonard system in the following cases:

(1) When the time occupied by the wind is short.
(2) For vertical shafts.
(3) For large outputs.
(4) Where the winding speed is very high.

The above conclusions may be considerably modified by the nature of the electrical supply. Where the power station is small or the winder is supplied through a transmission line of considerable length, the Ilgner system will be more suitable, but where the power station is large and near the winder, the Ward Leonard system is the better.

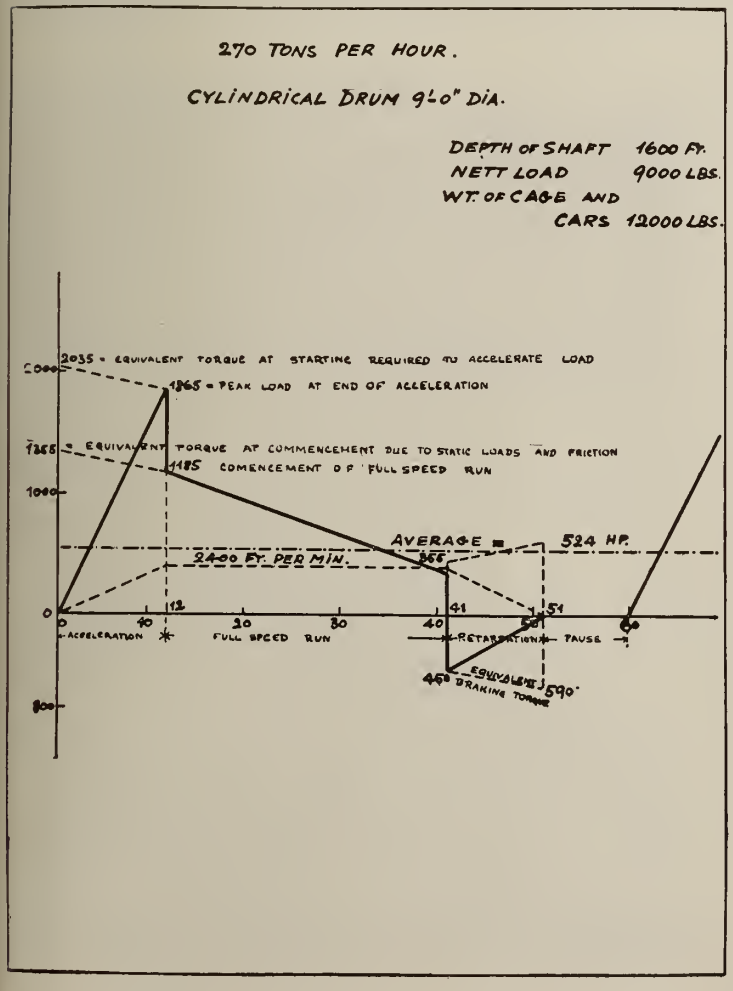

270 TONS PER HOUR.
CYLINDRICAL DRUM 9'-0" DIA.
DEPTH OF SHAFT 1600 FT.
NETT LOAD 9000 LBS.
WT. OF CAGE AND CARS 12000 LBS.
2035 = EQUIVALENT TORQUE AT STARTING REQUIRED TO ACCELERATE LOAD
1865 = PEAK LOAD AT END OF ACCELERATION
1185 = EQUIVALENT TORQUE AT COMMENCEMENT DUE TO STATIC LOADS AND FRICTION
1185 COMENCEMENT OF FULL SPEED RUN
AVERAGE = 524 HP.
2400 FT. PER MIN.
ACCELERATION
FULL SPEED RUN
RETARDATION
PAUSE
EQUIVALENT DRAKING TORQUE
590

Fig. 6.—Typical power diagram for a Ward Leonard winding engine.

Brake Gear.—The mechanical brake is so arranged that when it is required to bring it into action it is actuated by a weight at the end of a lever, but it is normally held off the drum by an air cylinder.

Under normal conditions the cams on the depth indicator actuate the control lever, so that the cages approach the bank at a very slow speed. When they reach the bank the driver brings them to rest by means of his control lever, and then puts on the mechanical brake to hold the cages in position by means of the brake lever. The brake lever is interlocked with the control lever, so that the driver cannot put on the brake by means of the brake lever until the control lever is at about its middle position, i.e., unless the cages are moving at a comparatively slow speed.

To enable the driver to stop the winder in case of any emergency arising, a third lever, the emergency lever, is placed on the driver's platform, and if this is operated it puts on the mechanical brake through the emergency gear and at the same time cuts off the excitation from the dynamo of the motor generator set.

Safety Devices.—As mentioned above, cams are provided on the depth indicator which keep the acceleration within safe limits, and the cage is brought gradually to a slow speed by the time it reaches the bank. An overwind device is provided, usually both on the depth indicator and in the shaft, which puts on the mechanical brake through the emergency gear and cuts off the excitation should the cage overwind the bank, thereby bringing the winding engine instantly to a stop. Should the air pressure or the excitation fail, the mechanical brake is put on by means of the emergency gear.

Fig. 10.—Direct current winding motor at the Markham Steam Coal Co. Depth of wind, 1,800 ft. Nett load per wind, 3½ tons. Maximum winding speed, 2,900 ft. per minute. Motor, 1,400 horse-power, at 51 r.p.m.

When men are being hoisted the throw of the main control lever is limited by means of a switch on the bank, so that the winding engine cannot be run above a certain speed.

Where electrical driving is adopted it is very easy to provide safety devices, and all those mentioned are designed to protect the plant against careless handling, but if the majority of safety devices were dispensed with, the Ilgner and the Ward Leonard winder would still be better protected against careless handling than the steam winder. The fact that it is impossible for an Ilgner or a Ward Leonard winder to race or run away makes it inherently safer than the steam winder.

Application of Ward Leonard System to Reversing and Three High Rolling Mills.

Nearly 60 large reversing mills are being driven electrically in different parts of the world and a modification of the Ward Leonard system has been installed in almost every case to meet these special requirements.

The power requirements of a reversing rolling mill impose much more severe conditions on the electrical plant than those of a large electrically driven hoist. With a large 36-in. or 45-in. blooming mill, ten to twelve passes are often made in a minute, and the power during individual passes may rise to 12,000 h. p. or more, while the total time of the passes, i.e., the total time that the ingot is between the rolls, is very short compared with total time taken to roll an ingot down to a bloom or billet. It is thus easily seen that the average power required from the power station is very much less than the maximum power which the mill motor has to give.

For example, in many electrically driven blooming mills, the average power is only one-sixth or one-seventh of the maximum power.

In the case of an electrically driven hoist, the duration of a wind would be perhaps one minute, followed by a pause of 20 seconds or so, and the maximum power required seldom exceeds 3,000 to 4,000 horse power, so that the average power is of the order of one-third of the maximum power. While, as has already been pointed out, it is frequently necessary to employ flywheels with winding engines it is always necessary to couple a flywheel to the motor generator set which supplies a reversing rolling mill motor.

A reversing rolling mill motor, on account of the rapidity with which it has to reverse, must be so designed that its moment of inertia is kept down to a minimum, and special precautions must be taken to see that the field of the generator supplying this reversing motor should build up as rapidly as possible. This has been accomplished so successfully that it has been found possible to reverse a large reversing mill motor having rotating parts weighing over 70 tons, 30 or 40 times per minute between a speed of 60 revolutions in one direction and 60 revolutions in the other, when no steel is being rolled. Such tests naturally cannot be made while steel is being rolled, because it would be quite impossible with the present type of live roller tables to return the ingots to the mill quickly enough, but such tests are useful in showing the very high rate of acceleration of the mill motor which can be obtained, and as a measure of the handiness of the mill.

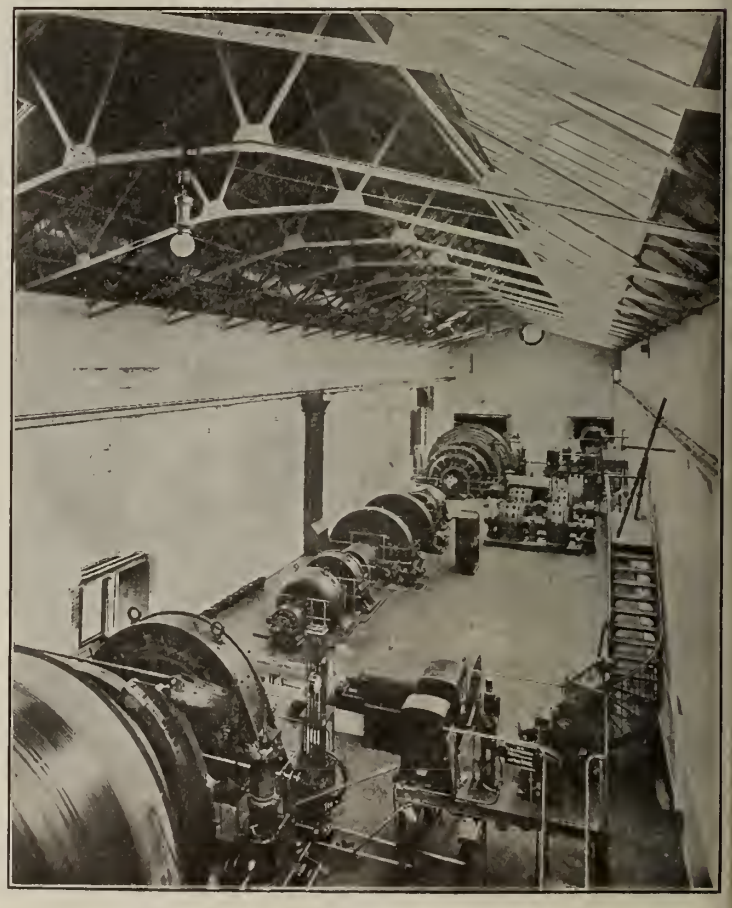


Fig. 13.—General view of the winding engine plant at the Markham Steam Coal Co.'s plant, showing both winding engines.

Power Diagram for Reversing Blooming Mill.—Under ordinary conditions the power diagrams for each wind of a hoist are identical and can be calculated with considerable exactitude from the conditions of working, but with a rolling mill the power diagrams for each pass vary very greatly from one another, and cannot be calculated with any accuracy, for the following reasons:

During the earlier passes heavy drafts are taken, but the ingot is quite short, consequently large powers are required for very short times; but as the ingot is gradually rolled out to a bloom of considerable length and reduced in section the drafts are diminished, as the reduction in area must be kept moderate, otherwise the bloom is damaged by the formation of surface cracks, etc., so that during the last passes the necessary power is not very great, but it is required for a considerable time.

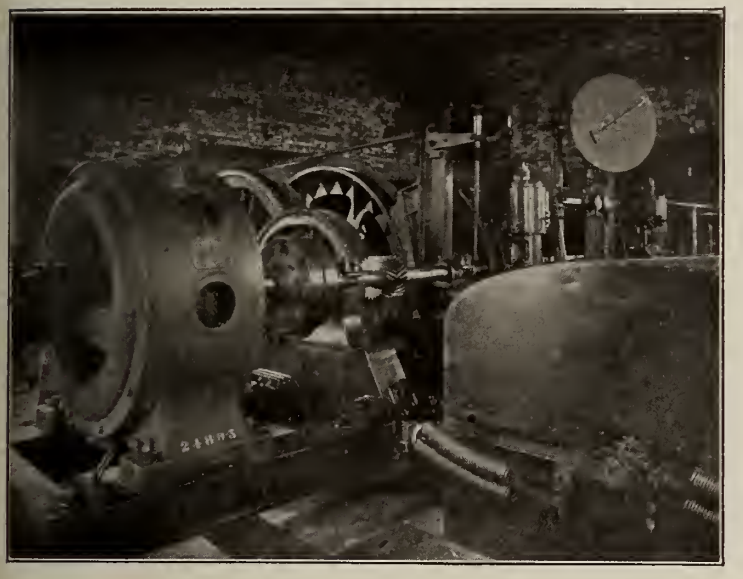


Fig. 23.—Cylindrical drum three-phase winder at the Acadia Coal Co., Stellarton, N.S., showing motor and double reduction gearing. Total length of slope, 4,921 ft. Nett load per wind, 11 tons.

During the first two or three passes the ingot still has its tapered shape and the metal is very spongy in character, so that the powers required are not very heavy and are very irregular. By the time that the last passes are taken the bloom has cooled down considerably, and while this cooling increases the specific power required. such drafts are taken that the power required for these passes remains much less than that for the first passes.

Action of Flywheel.—There is a great difference between the behavior of the flywheel coupled to the motor generator set used for driving a hoist, and that used for driving a rolling mill. In the case of a hoist where the power diagrams for each successive wind are almost indentical, and about an equal period elapses between each wind, the flywheel gives up power during a wind and regains it during the interval, thus serving to equalize the power between individual winds and intervals. In the case of a rolling mill, and particularly a blooming mill, the flywheel has to do a double duty, because during the first passes made on an ingot the mill motor has to give a large power for a very short time as the ingot is short, so that the energy consumption during the earlier passes is much less than the energy consumption during the later passes, where, although the power given by the motor is not so great, the ingot has been rolled out to a considerable length, so that a very considerable energy is required per pass. The flywheel, therefore, has to give up energy during the passes and regain it during the interval between passes, and also the flywheel gains energy during the first passes of an ingot and loses energy during the later passes, so that its speed variation has a double period, namely, a short period of about 5 to 10 seconds, corresponding to the partial equalization of power between the pass and interval, and a long period of about 3 minutes, corresponding to the equalization of power over the whole time of rolling an ingot.

As the flywheel used in connection with a rolling mill has to equalize the power over a period of three minutes or so, it is usually found that these flywheels are much heavier than those applied to winding engines. The motor generator set for a blooming mill is usually supplied with a flywheel weighing about 40 tons, while a motor generator set provided for a plate mill, or a finishing mill, is generally supplied with a flywheel weighing anything from 60 to 100 tons, depending on the work which has to be done. The motor generator set for supplying hoists or winding engines is generally provided with a flywheel of not more than from 20 to 30 tons. Such flywheels would run at a peripheral speed of about 20,000 per minute, though in some cases this peripheral speed has been considerably increased.

Such a 100-ton wheel running at this speed would have a stored energy of about 300,000,000 foot lbs. or 545,000 horse power seconds, and in falling 20% in speed would give up 108,000,000 foot lbs. or 195,000 horse power seconds.

The total work required to roll a 1½ ton ingot to a 4¾ x 4¾ billet is 59,000,000 foot lbs. or 108,000 horse power seconds.

Safety Devices.—The safety devices provided for an electrically driven rolling mill are of a much simpler character than those provided for a hoist, because it is not necessary to provide against the possibility of an overwind or the loaded cage falling to the bottom of the shaft due to the failure of the electric power. It is only necessary to protect the electrical plant and the mill itself against careless handling.

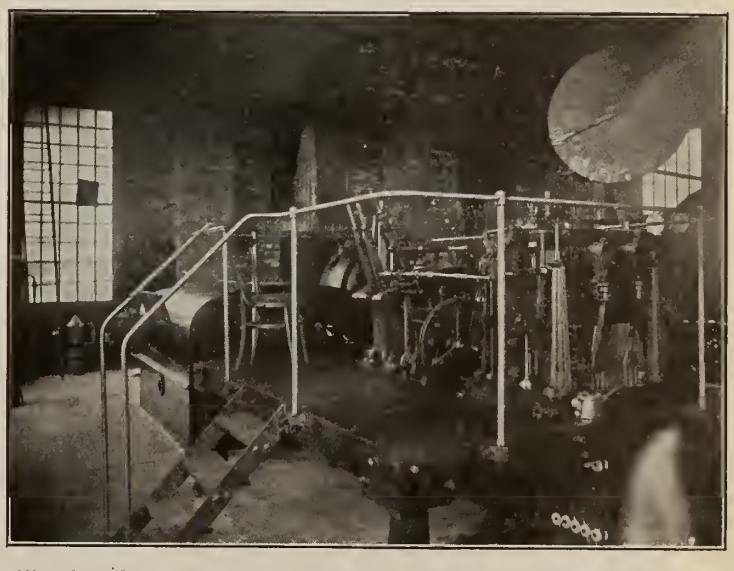


Fig. 24.—Control gear of three-phase winder shown in Fig. 22, showing main control lever, emergency lever and clutch levers. The reversing oil switch is on the right hand side and the liquid controller on the left hand side.

A circuit breaker is provided in the main circuit between the generator of the motor generator set and the mill motor to cut off the power from the motor in case, through carelessness, an attempt is made to roll a cold ingot, or too great a draft is taken on an ingot, imposing a greater strain on the motor and mill than they were designed for.

The circuit breaker is a protection against broken rolls as well as against damaging the motor, and it must be remembered that many rolls, especially the bottom roll, have a very small factor of safety. (Dr. Puppe, Iron and Steel Institute, Carnegie Scholarship Memoirs, Vol. II., page 300.) Such a circuit breaker would be most objectionable if used with a hoist, as only the prompt application of the brakes would prevent the cage falling in the shaft when the breaker opened, but with a mill, when the circuit breaker acts the motor merely comes promptly to a standstill, and if there is an ingot between the rolls, the mill can be reversed, the circuit breaker put in, the ingot run out of the mill again, and no damage is done.

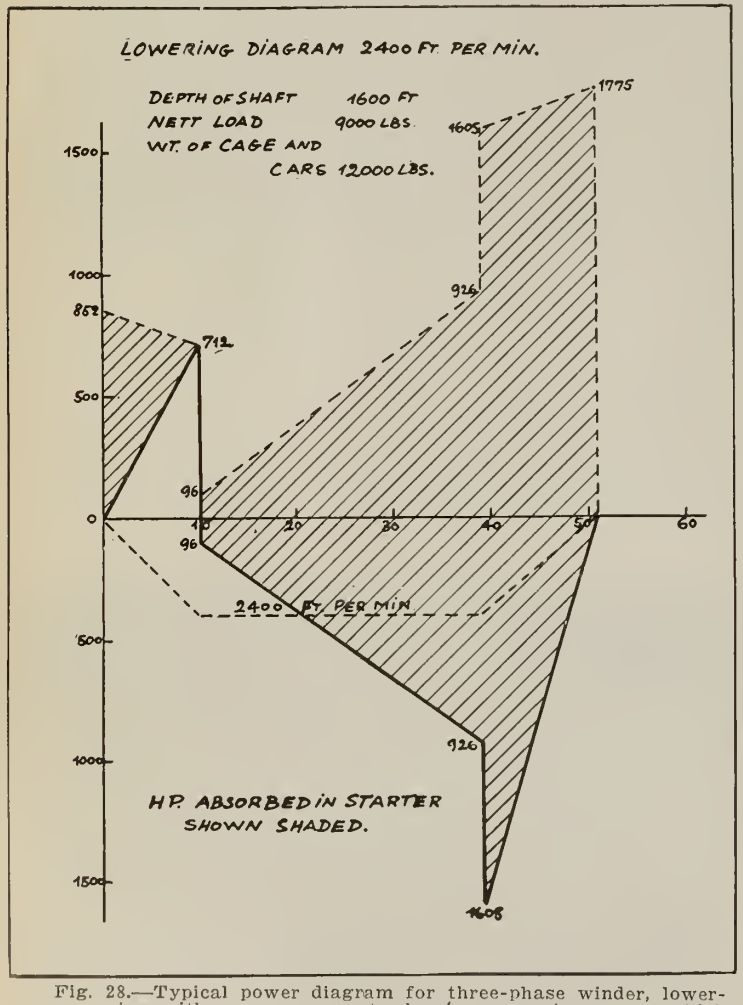


Fig. 28.—Typical power diagram for three-phase winder, lowering with reverse current, showing excessive power which is taken from the supply system and wasted.

A good deal of space in this paper has been devoted to description of safety devices, but it should not be considered on this account that there is any inherent risk in using such electrical plant, as the safety devices are to protect the plant against damage due to careless handling. The devices applied to steam hoisting engines, and particularly to steam reversing rolling mill engines, are of a much more rudimentary description, and the safety of such steam plants really depends on the skill and experience of the driver.

It should be particularly pointed out that the electrically driven reversing mill does not increase in speed as the ingot passes out of the rolls, while the steam engine, unless carefully handled, will race and run away.

Three-Phase System.

Application of Three-Phase Motors to Winding Engines and Hoists.

A three-phase motor cannot be built for a very low speed without its power factor being bad, which tends to upset the regulation of the supply system, and for this reason where three-phase motors are driving winding engines they nearly always run at higher speeds than the drums, and are geared to them. In the Ward Leonard or Ilgner system, however, where a direct current motor is used, this is almost invariably direct coupled to the drum.

Control.—The speed of a three-phase motor is controlled by varying the resistance in the rotor circuit so that all three-phase winding engine motors are naturally slipring motors, while the direction of rotation is reversed by interchanging two of the connections to the stator, so that a reversing switch must be provided for this purpose.

In order to explain the differences between the control of a three-phase winder and that of a Ward Leonard winder, it is necessary to refer briefly to the behavior of a three-phase induction motor when resistances are connected in the rotor circuit.

If the proper resistances in the rotor circuit of a three-phase induction motor are connected to reduce the speed by a given amount for a definite turning moment, the speed of the motor will increase if the turning moment which it has to give decreases, and it will decrease if the turning moment increases.

It will thus be seen that while with a Ward Leonard or Ilgner winder, the winder runs at a definite speed for each position of the control lever, and the speed of the winder is independent of the load in the cages, with a three-phase winder the speed does not solely depend on the position of the control lever, but also depends on the turning moment which the motor has to give, so that for a definite position of the control lever the speed may vary according to the position of the cages in the shaft and according to the load that is being hoisted, for as the loaded cage is being hoisted, its weight becomes more and more balanced by the weight of the rope attached to the empty cage.

With the three-phase winder, therefore, the manipulation of the levers would be different as different loads are being hoisted, and it is therefore impossible to employ cams on the depth indicator to limit the acceleration and to bring the loaded cage to a slow speed by the time it reaches the bank.

In the three-phase winder, therefore, we come back to the case of a steam engine where the wind is entirely in the hands of the driver and reliance must be placed in his skill for the safe handling of the plant.

Power Diagram of Three-Phase Winder.—Where the speed of a three-phase induction motor is controlled by placing resistances in the rotor circuit, and the motor is giving a definite turning moment, the same amount of power will be taken from the supply system whatever the speed of the motor may be. The turning moment multiplied by the speed gives the amount of power which the motor uses and the remainder of the power is wasted in the resistances. Thus, the three-phase motor involves great waste of power.

Fig. 27 is a power diagram for a three-phase winder with a cylindrical drum winding at the rate of 270 tons per hour from a shaft 1,600 feet deep, the maximum speed being 40 feet per second. The shaded portions of this diagram represent the power which is wasted in the resistances of the starter in starting and stopping the motor, and in this particular case the useful work done by the winder is 524 horse power minutes per wind. The amount of energy wasted in the starter is 325 horse power minutes per wind. Taking into account the efficiency of the three-phase motor the energy taken by the winder from the supply system is 910 horse power minutes per wind. The average efficiency of the electrical plant, therefore, is only 57,5%.

Comparison of Three-Phase Winder with Ward Leonard and Ilgner Winders.—Fig. 27 shows how large the power losses are in starting and stopping a three-phase winder. It also illustrates a case that is much more suitable for a Ward Leonard or Ilgner winder than a three-phase winder, and as the loss in starting and stopping a three-phase winder is very great, it will be seen that it is most advantageous to employ a three-phase winder where the starting and stopping is infrequent, and where there is a long run at full speed, when the three-phase winder is economical, or where there is a considerable interval between winds. These are practically the conditions of a long slope haulage.

Under such conditions a three-phase winder can easily prove more economical in power than the Ilgner or the Ward Leonard winder, because, with the latter, the motor generator set would have to be kept running continuously and this involves an unceasing though small expenditure of power, so that the energy taken to run the motor generator set can easily be more than the energy wasted in starting and stopping the three-phase winder.

The three-phase winder is advantageous:

(1) Where the capital cost of the plant is a prime consideration, as the total cost of the three-phase winder is from 20% to 35% lower than that of a Ward Leonard winder.

(2) Where the starting and stopping is infrequent and long runs at full speed are required, as is particularly the case with slope haulage.

Lowering Load.—There are three methods by which the load can be lowered with a three-phase winder.

(1) By controlling the speed with the mechanical brakes.

(2) By lowering at such a speed that the motor is run above its synchronous speed and so acts as a generator and returns power to the supply system.

(3) By reversing the connections to the motor so that it is giving its turning moment in the reverse direction to the rotation, and controlling the speed by the use of the ordinary control lever with reverse current.

(To be Continued.)

DUNSMUIR COLLIERIES.

Bondholders of Canadian Collieries (Dunsmuir), the great British Columbia mining corporation, are to meet on the 30th to consider a proposal that the company postpone its sinking-fund payments for five years. The Canadian Gazette considers that the proposal is "reasonable and should be cheerfully complied with." The circular of the directors says in part:

"A prolonged strike has continued for many months on the properties of the Canadian Collieries. The strike broke out in September, 1912, and speedily involved the whole of the company's mines both in the Comox and the Wellington fields. Subsequently towards the latter half of 1913 the strike extended to all of the colliery companies on Vancouver Island, and was accompanied by great violence and rioting. During the last few months the men have been returning to work, but conditions still continue difficult and labor scarce. The output of the Comox field has for some time been approximately what it was before the strike, but in the southern —Ladysmith—field the output is still small. In both areas disturbed conditions are still reflected in high working costs. It is expected that some time will elapse before normal conditions can be established in both the Comox and Wellington fields.

"This strike extending over nearly 18 months has caused serious loss of profit to the company, necessitating the standing charges for the past year being met to a large extent out of working capital. It has also caused serious delay in carrying through the scheme of new construction and development entered upon when the company was formed. At that time a sum of about £600,000 was provided to pay for the extensions then contemplated, and to provide the additional working capital required to carry on the increased business. This sum was estimated by the company's manager as amply sufficient for the purpose, but a further sum of about £300,000 will probably be required to carry out and complete all the necessary works.

"This sum certain large holders of preference and ordinary shares are willing to find as and when required, on certain conditions, one being that the holders of the first mortgage bonds agree to the postponement for a period of five years, i.e. until March 31, 1919, of the sinking fund, the first payment of which, in terms of the trust deed, is due on March 31, 1914, the minimum payment being £40,000.

"Power will be reserved to the company should circumstances make it desirable to commence payment of the sinking fund at an earlier date than March 31, 1919, and the resolution for the postponement of the sinking fund will provide that no dividend shall be paid on any share capital of the company until the company has commenced to make the sinking fund payments."—Financial Times.

McKINLEY-DARRAGH.

Net profits of the McKinley-Darragh Savage Mines for 1913 were $771,487, a decrease of $382,361 from 1912. A decrease in ore reserves is also shown. At the end of 1912 these were placed at 5,368,500 ounces and have now dropped to 3,210,000 ounces.

The cost per ounce of mining silver increased from 18½ cents to about 22 cents. Total silver recovered during the year was 2,214,026 ounces, compared with 2,717,383 ounces in 1912.

Dividends aggregating $584,400 were paid in 1913, and $134,862 was paid January 1, 1914.

ALBERTA OIL.

London, March 20.—At a statutory meeting of the British Alberta Oil Company, held at Birmingham yesterday, Mr. John Lee, chairman, announced that the company had contracted for drilling two wells in the Alberta oilfields, located in accordance with Mr. Cunningham Craig's instructions. Drilling, it was stated, would begin early in April.

Mr. Craig who attended the meeting, will leave shortly for Alberta, with an assistant, to complete a survey on 10,000 acres controlled by a company which considers it the most promising area yet taken up.—Montreal Star.

THE OCCURRENCE OF GOLD IN ONTARIO*

By J. B. Tyrrell

Up to the present time the Dominion of Canada has contributed £63,700,000 to the world's gold supply, and of this total the great placer or alluvial camps of Klondike in the Yukon territory, and Cariboo, etc., in British Columbia, have contributed respectively £30,000,000 and £14,400,000, leaving £19,300,000 as the contribution of both the placer and quartz mining camps of the rest of the Dominion. Of this latter amount the quartz or vein mines of Ontario have contributed, to December 31, 1912, £900,000, all of which came from localities in the latter province underlain by rocks of pre-Cambrian age. (The total production of Canada for the year 1913 was $16,216,131. The production of Ontario was $4,558,518.)

The question at once arises why, if Ontario is rich in gold-bearing lodes or veins, these have not been discovered or developed as they have been in other countries where similar rocks prevail.

The answer to this question is involved in a knowledge of the history of the country from the Pliocene period down to the present.

Pre-Cambrian rocks, similar to those of Northern Ontario, are known in many other parts of the world, and among them may be mentioned Minas Geraes in Brazil, Kalgoorlie in Western Australia, Rhodesia and India. In all these places gold-bearing lodes have been worked extensively, and have yielded enormous returns to those who have been fortunate enough to own them.

But in these countries, as well as in that far northwestern portion of our own country, the Klondike, rock decomposition went on continuously throughout all later geological periods. Rain descended on the loose decomposed rock, dissolved parts of it, and carried the insoluble portions down into the streams, and these streams in their turn carried the lighter portions down into the sea, while the streams themselves concentrated the gold and other heavy minerals contained in the decomposed rock into the more protected parts of their channels, forming placer deposits. Compared with gold-bearing quartz veins or lodes in undecomposed rock these placers are readily discovered, and when discovered, yield up their riches quickly and easily to the miner. In addition to which, 5 dwt. of gold to the ton of gravel constitutes a rich placer in almost any country, while a similar quantity of gold, in quartz, is impossible to extract at a profit except under the most favorable conditions. Placers, when discovered, cause a rush or stampede of prospectors and miners into the country; these men quickly scatter about and greatly extend the knowledge gained by the original discoverers.

With the confidence engendered by abundance of gold at various places in these placer deposits, and with the necessary experience and capital supplied directly or indirectly from the same sources, search is then instituted for quartz veins or lode deposits, often successfully, so that great quartz veins have been opened up in the same countries, and in others in the vicinity of them. But for the placer mines of Brazil, California, Colorado, Australia, etc., it is doubtful whether the rich gold quartz veins of these countries would have even yet been discovered or developed.

In Ontario gold-bearing quartz veins occur in many places, and in the very long period which intervened between that time in some of the later Palæozoic Epochs when the Pre-Cambrian rocks were raised above the Palæozoic seas, and the close of the Pliocene, rock decomposition on a tremendous scale undoubtedly took place, for during all this immeasurably vast interval of time these rocks were above the level of the ocean, and were constantly subjected to the corroding influence of atmospheric and meteoric agencies. This decomposed rock was then carried away by streams which assorted the undissolved portions and left the heavy gold in the valleys, while they carried much of the lighter material down into the sea.

In this way alluvial deposits, rich in gold, were undoubtedly formed in many parts of Ontario, where they must have existed during the Pliocene and earlier periods. The rich alluvial gold-fields of the Klondike, where, in an area underlain by Pre-Cambrian rocks, sedimentation has been continuous from Miocene times down to the present, give us some indication of what must have been the extent and character of those alluvial deposits in Pliocene times.

But in the Province of Ontario, and in those portions of Canada to the west and north-west of it, rock decomposition, and concentration through the agency of running water, have not been continuous down to the present, but on the contrary these processes were suddenly interrupted in Post-Pliocene times by the invasion of vast fields of ice, which moved with irresistible force over the country, and swept all the disintegrated rock, gravel, sand and other loose material along with it, even planed off and carried away some of the underlying hard undecomposed rock itself. All this rotten and broken rock material was kneaded together by the flowing and crushing of the ice, which at the same time moved it southward, and deposited much of it over the southern parts of Ontario, and adjoining portions of the United States.

In this way the gold-bearing alluvial deposits which undoubtedly existed in many parts of Ontario during the Pliocene Epoch were removed and destroyed by glacial agencies.

Since the close of the Glacial Period, when the last of the ice invasions took place, there has not been a sufficient lapse of time to allow for any extensive decomposition of the hard Pre-Cambrian rocks, or of the included gold-bearing lodes when such are present. Consequently the present streams have been unable to form any important gold placers on account of a lack of supply of proper gold-bearing material from which the metal could be concentrated.

The few low-grade placers which are known to exist in the province have undoubtedly been derived from a re-concentration of glacial debris containing a little gold, and not from a concentration of material worn directly from the rock itself.

In consequence therefore of the erosive action of the ice during the Glacial Period, and of the comparative recency of that period, there are no rich and extensive gold-bearing placer deposits in Ontario such as are found in most other gold-producing countries.

As these gravel or placer deposits have in most cases contained the gold first discovered in other countries, and as this gold was quickly and easily extracted from them, they were the means of drawing together the

*Extracts from a paper presented at the Nov. 20, 1913 meeting of the Institution of Mining and Metallurgy.

first great throngs of prospectors, and their absence from the Province of Ontario, and the consequent lack of this powerful attractive agent, has militated strongly against the discovery and development of its gold resources.

Gold was discovered in Ontario in the summer of 1866, in a quartz ledge on the property of Mr. J. Richardson in the Township of Madoc, north of Lake Ontario, but so little was known about gold by the men living in the vicinity who discovered it, that the identity of the metal was not determined until it was seen by H. G. Vennor, then in the employ of the Geological Survey of Canada, who immediately recognized it.

Five years later, in 1871, gold was discovered in quartz veins in the country west of Lake Superior, and from that time onwards up to the present it has been found in many places, but until recently very few, if any, of these discoveries resulted in the opening up of productive and profitable mines.

Such mines have now unquestionably been found in the Porcupine District. The characters and conditions of occurrence of these payable gold-bearing veins are much the same as many, if not all, of those which had previously been exploited in other parts of the province. The occurrence of an ounce of gold more or less in a ton of vein matter can scarcely be regarded as of sufficient importance from a geological point of view to place these richer veins in a class by themselves, although the additional ounce may make a vast difference in their commercial value, and in the interest which may be attached to them in the promotion of the general welfare of the community.

In all places where gold has been found it has occurred more or less closely associated with quartz veins in Pre-Cambrian rocks, usually near the contact of acid intrusions with some basic rocks of either igneous or sedimentary origin.

The Porcupine District mentioned above has several profitable gold mines producing gold from veins of great regularity and continuity. Another district in which gold-bearing veins of very similar character also occur is situated in the vicinity of Swastika Station, on the T. & N. O. Railway. As the rocks with which the veins are here associated are proving to be sufficiently widespread to include many other areas both in Ontario and Quebec where gold is known to occur, and as the conditions of occurrence of these rocks are rather clearly defined at Swastika and in its vicinity, a brief description of this district will be of interest.

Swastika District.

The Swastika district* is fairly typical of the Archæan peneplane of Northern Canada.

Its surface configuration is characterized by low rounded hills and shallow valleys in which lie beautiful clear lakes with very irregular outline, connected by smaller or larger streams.

The country has all been severely glaciated from a northerly direction, and the rocks which underlie it have been planed down until all the weathered and softer portions have been removed, and that which remains is the hard rock, unaltered by surface or atmospheric agencies.

These rocks, however, are not now generally exposed over large tracts, but are usually covered with a coating of clay or sand of glacial or post-glacial age, and these surface deposits support a dense forest of spruce and other timber which, with the overburden of soil, makes the work of prospecting slow and difficult.

The rocks which underlie the country, and in, or in connection with which the gold-bearing quartz veins occur, are as follows, arranged in increasing age from above downwards:

Glacial and Post-Glacial
- Till, sand, clay and boulders.

Pre-Cambrian
- Diabase
- Minette and lamprophyre
- Albite diorite
- Felsite
- Conglomerate
- Diorite-porphyry
- Greenstone=highly altered diabase, amygdaloidal basalts, etc.

Beginning with the oldest, the basement rock of the district is a fine-grained greenstone of Keewatin age, which in many places is hard and massive, while in other places it may be slatey or schistose. The more massive phases often exhibit the ellipsoidal or pillow structure so common in basic rock of this age.

Intruded into the greenstone is a batholitic mass of diorite or feldspar-porphyry, which on the surface weathers to a dirty white color, but on fresh exposure varies in color from light green to red. It is usually distinguished by the presence of light-colored phenocrysts of plagioclase, often altered to saussurite, with occasional crystals of biotite, imbedded in a finer grained matrix of plagioclase, hornblende and chlorite. Quartz is also often present, and in some places to such an extent that the rock becomes a quartz-mica-diorite. In other places the ferro-magnesian constituents may be absent and the rock then partakes of the character of aplite.

Overlying the greenstone and diorite-porphyry are conglomerates, greywackes, etc. They consist of a green fine-grained groundmass, the particles of which are in places rounded and water-worn, while in other places they are sharp, crystalline and angular, suggesting a volcanic or tufaceous origin. Some of the beds are fine-grained throughout, while others are packed with well-rounded, water-worn pebbles or boulders of the older rocks, such as greenstone, diorite-porphyry, red jaspilite, etc. In the finer varieties of these sediments it is often difficult to distinguish them from altered igneous rocks, but the presence of particles of jasper usually furnishes a distinguishing characteristic.

All have been deposited in water in horizontal or approximately horizontal attitude, but since their deposition they have been squeezed and upturned, so that the beds are often highly inclined. Many of the pebbles are shattered and broken, and in some cases the green matrix has been squeezed in between separated portions of pebbles of such distinctive rock as red jasper.

In many places the relative ages of the diorite-porphyry and conglomerate are difficult to determine with certainty, for, in the immediate vicinity of Swastika, the contact is obscured by superficial deposits, and near Kirkland Lake, a few miles further north-east, it is almost everywhere marked by a strong well-defined fault. However, in both places the conglomerate contains a plentiful supply of pebbles of the diorite-porphyry, and at one place near Kirkland Lake, on Claim No. 2566, the unfaulted contact was clearly seen. The pebbles are there rolled and well rounded, and, immediately above the contact, are composed entirely of diorite-porphyry packed together almost as closely as they can lie. This occurrence, together with the char-

*See also a report on "The Swastika Gold Area," by E. L. Bruce, in the 21st Annual Report of the Bureau of Mines (for Ontario), 1912, pp. 256-265, with map.

Note.—In the examination and determination of a large number of microscopical sections of the rocks of the district, I was assisted by Prof. T. L. Walker and Mr. G. S. Scott.

acter of the pebbles in many other places, shows clearly that the conglomerate is later in age than the diorite-porphyry.

The greenstone, diorite-porphyry and conglomerate are the three most abundant rocks of the country, but, in addition, there are several varieties of igneous rocks which have been intruded into or through those above enumerated in the form of dikes or sills.

Dikes of minette or "lamprophyre" from a few inches up to many feet in width cut both the porphyry and conglomerate at the Tough-Oakes mine, and on other mining claims in the vicinity of Kirkland Lake. They are approximately vertical, and follow the general strike of the conglomerate, but they are all later in age than the conglomerate, for they have not participated in the folding to which the latter rock was subjected, and which had therefore assumed its present conditions and attitude before the minette was injected into and through it.

Quartz Veins.—Quartz veins occur in the greenstone, diorite-porphyry and conglomerate or greywacke, and some veins have been also observed in the albite-diorite. Since, wherever gold occurs, it is more or less closely associated with these quartz veins, a knowledge of their character and mode of occurrence is highly important from an economic standpoint.

Most of the veins dip at a high angle, usually not more than a few degrees from vertical, though the dip may vary to some extent at different depths. Thus, at one place a vein may dip at an angle of 70°, while above or below it may be vertical, or even dip in the opposite direction.

In the greenstone and porphyry the veins are of quartz of a white or light bluish color, often enclosing irregular masses of country rock. Very often the vein matter is distinctly banded, and in such cases the bands may be of green chloritic material, or they may contain a considerable percentage of dark tourmaline.

In the conglomerate the veins may contain a considerable proportion of specular iron ore, or, as in the case of the Tough-Oakes vein, they may contain a very large quantity of molybdenite. In almost every vein in which gold is found pyrite is more or less freely disseminated through the quartz, and also through the country rock adjoining the vein. Some of the gold is intimately associated with this pyrite, while other portions of it are scattered through the quartz quite independently of the pyrite, so that in milling it is possible to catch from 50 to 80% of it on amalgamated plates.

Faults.—In the tremendous disturbances to which these old rocks have been subjected, numerous slips have occurred, and faults have been formed of greater or less displacement. The fault planes may be simple or composite, and the slickensided surfaces show movement varying all the way from the vertical to the horizontal. Most of the faults are reverse.

In the northern portion of the Township of Teck the main fault zone runs roughly east and west parallel to the contact of the diorite-porphyry and conglomerate and to strike of the folding which has affected the rocks in the Tough-Oakes and adjoining claims, and also to a rather prominent lamprophyre dike which crosses the country near the above contact.

Farther south most of the faults observed are near the contact of the diorite-porphyry and greenstone, and are much more irregular in their direction and distribution, often crossing and intersecting each other at various angles. The main direction in any particular locality is probably determined by the direction of the line of the porphyry-greenstone contact. They appear to have begun to form shortly after the intrusion of the diorite-porphyry and to have continued to form until the close of the period of disturbance in which the amprophyre dikes were injected into the adjoining rock.

The veins in this district, though not everywhere throughout the Pre-Cambrian rocks of Ontario, are usually associated with these fault planes, so that one or other or perhaps both of the walls may be smooth and well-defined. In one case a vein was seen to follow a fault plane for a certain distance to the intersection of another fault plane almost at right angles to it, when the vein turned sharply and followed the cross fault, the dark bands (of growth) in the vein turning sharply with the change in direction.

In other cases cross faults may pull or tear apart original fissures in which veins were being formed, permitting widening of the veins at and near the intersections, or the fissures may have been pulled back on one side of the cross fissures and not on the other, thus forming wedge-shaped enlargements of the veins on one side of the intersections.

Many of the quartz veins are at or near the contact of the diorite-porphyry and greenstone or conglomerate. The contact zone is not usually very sharply defined, for the rocks were very much disturbed, crushed and faulted by dynamic agencies as they assumed their present condition after the intrusion of the feldspar porphyry. The veins may run parallel to the general trend of the contact, or they may branch off at angles from it along subsidiary fissures which have extended out into one rock or the other.

As stated above, the main veins usually approximate to a vertical attitude, while apophyses may branch off from them in all directions. Some of them were large, while others might be quite minute. Where such minute veinlets carry gold, they may convert a considerable extent of country rock adjoining the veins into payable ore.

In the northern portion of the Township of Teck, the gold is to a very large extent closely associated with molybdenite, which chiefly occurs along the walls of the veins, and is later in age than most of the quartz.

In the porphyry-greenstone contact zone the fault fissures, when first formed, seem to have been usually accompanied by intrusions of felsite, which, as already stated, is composed of the same minerals as the diorite-porphyry, after which quartz was introduced, often in definitely banded form, and as this quartz was fractured by continued movement, gold and other minerals associated with it, including tellurium in some form, were also introduced. In some cases the movement in the fault was continued until the quartz was broken down into an irregular fault-breccia.

Near the porphyry-conglomerate contact the veins run in very definite courses, and occupy fissures which cut indifferently across from one rock to the other.

The distinguishing feature of all these gold-bearing veins is their close association with intrusive masses of diorite or feldspar porphyry rich in soda or soda-lime feldspar. While these veins were not derived directly from this rock, for it had consolidated, had been fractured, quartz veins had been formed in it, and these again had been fractured, before the gold was introduced into them, it is probable that the later intrusions of felsite, albite-diorite and possibly also of lamprophyre were all phases of the same rock, were derived from the same original magma, and that the gold has also been exuded from this same magma.

In an undeveloped country, such as the northern parts of the Province of Ontario, in which gold mining is in its infancy, but in which it may be expected to have a much more extensive development, a knowledge of the way in which the gold occurs, and of the rocks with which it is associated, is of the first importance.

The Swastika district has been merely taken as a type to illustrate its occurrence in the Pre-Cambrian rocks of Northern Ontario. From the Harricanaw country of Northern Quebec in the east, westward through Northern and Western Ontario, as far as Lake of the Woods, similar conditions appear to prevail, and it would seem not improbable that in the association of gold with certain definite types of rocks, the whole of this vast country may be one metallogenetic province similar in general character to that small portion of it here briefly described.

Contributed Remarks.

Dr. J. M. Bell: As a geologist who has traveled widely throughout the Canadian Hinterland both in Northern Ontario, and the region still farther North underlain by Pre-Cambrian rocks, Mr. Tyrrell is well qualified to address us on the subject with which his paper deals.

He has briefly mentioned several localities at which gold has been found in Ontario, and has given a more elaborate description of the rocks in the new gold field of Kirkland Lake, which he has taken as a type. While public attention is being riveted to some extent on this locality, it is interesting to learn of the various rocks of the district—greenstone schists, diorite porphyry, conglomerate, felsite, albite-diorite, minette, lamprophyre and diabase.

I do not agree with Mr. Tyrrell that the Kirkland Lake veins are typical of most of the Ontario veins. The gold deposits of this field consist generally of very narrow quartz veins, characterized by the mineral molybdenite and in places exhibiting specular showings of gold.

The country rocks are diorite-porphyry and a conglomerate in which occur brilliant pebbles of jasper. Though in places the country adjoining the narrow veins is highly silicified and gold-bearing, it is not characterized by much visible vein quartz. The veins of Kirkland Lake are on the whole well-defined, and the fissures appear to be persistent.

The gold veins of Porcupine are to my mind much more typical of others in Ontario than are those of Kirkland Lake. In that camp the deposits are of two more or less general types, (1st) the Dome type, consisting of large irregular lenses of white quartz, with, in some places wonderful showings of free gold, but of a generally low tenor, and (2nd) the Hollinger type, consisting of generally strong and fairly persistent quartz veins, with inclusions of schist. Gold occurs in both types in the quartz and in the schist. The walls of neither type are generally well-defined, and quartz stringers commonly ramify from the main veins into the country.

Deposits of quartz, very similar in character to those of Porcupine, occur at Swastika, Sturgeon Lake, Michipicoten, the Lake of the Woods, and in many other parts of the Ontario wilderness. They differ, however, in one important respect. They have not yet been proved to be sufficiently rich to be profitable to work.

The Porcupine Field, as is well-known, was only discovered in 1909 and in 1911 was devastated by fire. It is highly creditable that in so short a time as the two years that have passed since then, so many mines in the camp should already have become productive. The monthly output of the Hollinger is about $140,000, that of the Crown Porcupine about $50,000 or $60,000, and that of the Dome a somewhat greater amount than the latter.

Mr. Tyrrell has mentioned the difficulty of prospecting in Ontario, and has said that the great glaciers which in the past covered Ontario carried away the gold found prior to the invasion of the country by ice, so that there is no wash to lead the prospector to locate gold-bearing veins. This is quite true, and in addition he has to cope with the difficulties of a very dense vegetation, and in many places a covering of moss. He soon learns to know that in a certain formation or formations in any locality he may expect to find quartz veins which he hopes to prove valuable, and may locate a likely area, but even here he may search indefinitely, and miss in his stripping a valuable deposit within a few feet, as there is no detrital gold, in the overburden, to give the scent.

Mr. Stephen J. Lett: The author informed me, in answer to my inquiries before the meeting, that the earlier writers had been mistaken about the identity of the "graphitic material," which they had said was such a marked feature of the deposits, there being no graphite present as a matter of fact, and what had hitherto been mistaken for graphite has proved to be molybdenite. I mention this for the benefit of those who did not hear question or answer, as the matter is of great interest. But this is not the only matter upon which the author and the earlier writers differ one from another, and as he did not criticize the papers and reports referred to in his footnotes, perhaps he will deal with a few points which have occurred to me in reading his papers and the papers, etc., in question.

Is it a fact that, as stated by one writer, the gold is commonly associated with "much secondary quartz calcite and sericite," and if so, from what is the sericite derived if the feldspars are soda-lime feldspars?

Spearman writes "the common variety of porphyry is a reddish alkali porphyry with predominating orthoclase phenocrysts"; he also says that the acid porphyries are genetically associated with the deposits; but another writer says that their favorable influence cannot be of a genetic nature, for they are much older than the deposits. Which is correct?

Again, Walter Baelz states that the gold-bearing magma is directly connected with great granite intrusions, but the granites mentioned by the author are of Laurentian age, and the deposits are much younger; besides, the author apparently does not associate the granites with the deposits, though the minerals mentioned by him as associated with the gold are such as are usually associated with acid magmas. On p. 9, when mentioning together the veins in the greenstone and porphyry, the author fails to take advantage of the favorable opportunity for referring to the influence of the "country" on the gold contents. This being an important matter from an economic standpoint, it would be useful to have the author's experience on this point, particularly as one writer has clearly stated that the greenstone is decidedly unfavorable.

It has been stated that the proportion of silver to gold has increased with depth; any information on this point cannot fail to be of interest.

Mr. J. B. Tyrrell: Dr. J. M. Bell does not agree with me "that the Kirkland Lake veins are typical of most of the Ontario veins," but that "the gold veins of Por-

See also the following papers:—"The Goldfields of New Ontario," by Walter Baelz. Translated by T. L. Walker. Can. Min. Journal, May 1, 1912, pp. 299-304; "Kirkland Lake Gold Deposits," by R. E. Hore. Ibid., July 15, 1913, pp. 424-31; "Ore Deposits of Kirkland Lake District," by Charles Spearman, Ibid., October 1, 1913, pp. 599-601.

cupine are. . . . much more typical of others in Ontario than are those of Kirkland Lake." He divides the Porcupine veins into two types, "(1st), the Dome type, consisting of large irregular lenses of white quartz," and "(2nd), the Hollinger type, consisting of generally strong and fairly persistent quartz veins, with inclusions of schist."

The Porcupine gold-bearing veins, though sub-divided by Dr. Bell into two classes, on what would appear to be physical characteristics may, on a little consideration, be recognized as agreeing very closely with those described at Kirkland Lake. In the Porcupine area, both at the Hollinger and at the Dome mines, the veins, though differing somewhat in shape, occur near the contact of acid porphyritic igneous rocks and basic greenstones or conglomerates, the veins sometimes occurring in the porphyries themselves, but much more often in the contiguous rocks. Both rocks are usually somewhat foliated and have evidently been subjected to considerable pressure or strain. It was doubtless the physical conditions which prevailed in those rocks at the time when the veins were formed, providing channels for the passage of the solutions bearing quartz, gold and other associated minerals, that controlled the general shape of these veins. For instance, the veins on the Hollinger are nearly vertical, and the rocks containing them appear to have been bent around a boss of basic greenstones which lies to the south of them. Their general appearance strongly suggests the saddle veins of Nova Scotia, with this difference, that in this case the saddle is lying on its side. The horizontal bending of the strata has probably given rise to larger ore channels at or near the apex of the bend than elsewhere, and may account for the greater richness of this property than those adjoining it.

The acid porphyry which is found associated with the gold in the Porcupine country has generally been spoken of as a squeezed quartz porphyry. That on the McIntyre property, south of Pearl Lake and east of the Hollinger mine, was found to contain large phenocrysts of orthoclase and plagioclase in about equal proportions, imbedded in a fine grained ground-mass of feldspar, quartz and sericite. A very few phenocrysts of quartz were also observed in it. The plagioclase is a soda-lime feldspar with a preponderance of lime. In this particular instance the porphyry had been much crushed; but a little further west, on the opposite side of the Hollinger mine, it was found in some drill-holes in a less altered condition, consisting of a holocrystalline rock with large phenocrysts of feldspar in a coarse matrix of feldspar, chlorite and sericite. A few of the phenocrysts are orthoclase, but most of them are plagioclase, in which the lime preponderates over the soda.

In the vicinity of the Dome, the porphyry examined has a much larger percentage of quartz, though some of the phenocrysts are of soda-lime feldspar.

Thus it will be seen that in their mode of occurrence, associated with porphyries rich in soda-lime feldspar, the gold-bearing veins of the Porcupine district fall in line with those described from Swastika and Kirkland Lake.

As stated in my paper, similar porphyries occur associated with the gold-bearing veins throughout the Pre-Cambrian areas of Canada. Among these Mr. A. L. Parsons has drawn attention to the fact that several of the gold-bearing veins on Lake of the Woods are definitely associated with dykes rich in plagioclase.

In answer to Mr. Lett's first question, whether it is true that the gold is commonly associated with "much secondary quartz, calcite and sericite," it is undoubtedly true that most of the primary quartz in the veins had been much fractured before the gold was introduced into it. In some places these quartz veins have numerous cross-veins of secondary quartz in them, but as far as I am aware this secondary quartz is not usually rich in gold.

Calcite is not a common constituent in the richer veins, though it is very common in the adjoining rocks, being probably derived in part from the decomposition of the plagioclase. Sericite is also often present near the walls of the veins, having probably been derived from the decomposition of some of the orthoclase present in the porphyry.

In regard to the character of the porphyry, I must take issue with Mr. Spearman's statement that orthoclase phenocrysts predominate. I have myself examined or have had examined for me a large number of microscopic slides of this porphyry from a number of localities, and I find that, while orthoclase is usually present, and is sometimes abundant, plagioclase greatly predominates in this rock which I have designated "diorite-porphyry," and which Mr. Bruce in his official report published by the Bureau of Mines of the Province of Ontario, calls "feldspar-porphyry."

Since this paper was presented to the Institution, the Bureau of Mines of Ontario has also published a very valuable "Map of the Kirkland Lake and Swastika Gold Areas," by A. G. Burrows, with marginal notes. On this map Mr. Burrows also uses the term "feldspar-porphyry" for these rocks. He regards them as later in age than the conglomerates (of the Timiskaming series), but the evidence which I presented in my paper shows clearly that they are earlier. I consider that, though the porphyries are older than the gold-bearing veins, the latter are genetically associated with them to this extent, that they have been derived from the same deep-seated magma.

With regard to Mr. Baelz's statement that the gold-bearing veins are connected with great granite intrusions of Laurentian age, I have no exact evidence as to the relative ages of the porphyry and the Laurentian granites, except that stated for the Harricanaw district where Laurentian granites are intruded by porphyry similar to that at Kirkland Lake, and gold-bearing quartz veins are found in the granite adjoining the porphyry.

As to the influence of the country rock on the gold contents of the veins, I have but little evidence to offer. At the Hollinger property some of the richest veins are in an old greenstone, which is a highly altered diabase or basalt. In the Pearl Lake section of the Porcupine country the porphyry extends northeastward as a tongue into the adjoining country, with basic greenstones, such as those above mentioned, on both sides of it, and the gold-bearing veins have an undoubted tendency to form in this greenstone. Some of the veins, however, are in the porphyry, which is then often altered into a calc schist.

In many other places in the Pre-Cambrian areas of Northern Ontario quartz veins are scattered irregularly through the contact zone between porphyry and greenstone. In most of such cases they are short, and where gold is present in them it is also likely to be in short irregular shoots.

I would consider that the extent and value of the gold-bearing veins in the greenstone was much more fully controlled by the proximity and size of a mass of intrusive porphyry, and by the length and width of the fissures through which the gold-bearing solutions were able to circulate, than by minute difference in the character of these old basic Pre-Cambrian rocks.

In the Porcupine district I believe that the percentage of silver as an alloy of gold is practically constant at any depths yet reached, but in the Kirkland Lake district, where tellurides of gold, silver and lead are present in appreciable quantities, the silver in the ore undoubtedly varies with the quantities of tellurides present. It is hardly likely, however, that the grade of the gold itself, and the quantity of silver which is alloyed with it, have suffered any change at any depth to which the shafts have yet reached in the Kirkland Lake district.

I can only repeat what I said in an earlier part of this paper, that my object in bringing the occurrence of gold in Ontario before members was to point out the association of gold-bearing veins in our Pre-Cambrian areas with diorite-porphyries, or intrusives rich in soda-lime feldspar.

Dr. Malcolm Maclaren, in a recent paper in the Mining and Scientific Press, has clearly pointed out a similar association in the Pre-Cambrian rocks of Kalgoorlie in Western Australia.

In summing up the value of a knowledge of the association of the gold-bearing veins in Western Australia with the intrusive dykes, Dr. Maclaren* says: "It is not too much to say that had a geological map, showing all the porphyry and porphyrite dykes of the region, been available in 1893, every deposit now known, and some still unknown, would have been discovered within three months, and thousands of pounds' worth of useless work and misspent energy avoided."

Mr. Stephen J. Lett: I have received the following communication from Mr. A. G. Burrows, Assistant Provincial Geologist, Toronto. As the information embodied in the communication may be of interest to the members I send it as a contribution to the discussion on Mr. J. B. Tyrrell's paper.

Mr. A. G. Burrows: My attention has been called to the paper appearing in Bulletin 110 of the Institution of Mining and Metallurgy entitled "The Occurrence of Gold in Ontario," by J. B. Tyrrell, and also to the subsequent discussion of this paper by yourself and Dr. J. M. Bell.

I think that Dr. Bell is correct in stating that the occurrence of gold at Kirkland Lake is not typical of Ontario gold deposits.

The quartz veins in the best deposits so far discovered at Kirkland Lake are extremely narrow, usually only a few inches in width, but there is a considerable portion of replaced or impregnated wall rock along these veins which sometimes carries gold in economic quantities. There are other veins or lenses of quartz roughly parallel to a main vein, and also cross stringers of quartz which have allowed an extensive circulation in the adjacent wall rock. The ore deposit, consisting of quartz, calcite, country rock, etc., has been greatly disturbed and brecciated. A sample of ore has a dark grey appearance, and, unless wet, is sometimes difficult to distinguish from ordinary rock. This ore is quite different from most of the gold ore from other parts of the Province, which consists so largely of white glistening quartz. The richness of the high-grade ore in gold and silver, as shown by shipments, and the presence of so much telluride (altaite) are noteworthy features.

For some time it was thought that the ore carried graphite, but Mr. C. A. Foster, of the Tough-Oakes mine, had the mineral, which usually occurs as a film on fracture planes, determined as molybdenite, which was confirmed by further tests at the Provincial Assay Office of Ontario. Graphite, if present, occurs only in minute quantity. Molybdenite has also been observed in ore from the Swastika area, a few miles to the south-west of the Kirkland Lake area.

As to the query: "Is it a fact that, as stated by one writer, the gold is commonly associated with much secondary quartz, calcite and sericite, and if so from what is the sericite derived if the feldspars are soda-lime feldspars?" Original and secondary quartz in a vein can be distinguished with difficulty, particularly when a great portion of the quartz has been finely fractured. It is very likely that secondary quartz does exist in the veins. Secondary calcite is observed in all the thin sections examined. Sericite is present in some of the ore, but only to a small extent. Sericite, like calcite, is found in almost all the altered rocks of northern Ontario and may apparently be a migratory mineral.

The prominent phenocryst of the porphyry is a plagioclase near the albite end of the series, but there is some replacement by $KAlSi_3O_8$ (orthoclase). Blades of sericite, sometimes in zonal arrangement, occur in the plagioclase phenocrysts.

An analysis of porphyry from the Teck-Hughes property gave—Silica, 66.48%, Al_2O_3 15.42%, Fe_2O_3 1.05%, FeO 1.18%, CaO 3.15%, MgO 1.67%, Na_2O 5.92%, K_2O 2.56%, H_2O 0.30%, CO_2 2.65%.

The gold deposits of the Kirkland Lake area occur in sedimentary rocks of the Timiskaming series, and also in the reddish feldspar-porphyry which intrudes the older series. Veins have been found which cut both the sedimentary and igneous rocks. In the Swastika area the productive veins are in the greenstone near the contact with the feldspar-porphyry. The occurrence of these veins in the proximity of the contact of the older sedimentary or igneous rocks with an intrusive dyke rock (porphyry) is very suggestive of some genetic relationship between the veins and the intrusive rock.

The intrusion of the porphyry would shatter the older rocks along the contact, while the cooling, shrinkage and readjustment of the intrusive would result in the formation of the narrow fissures, later filled with quartz, which are so numerous in the porphyry itself. The vein filling could have ascended through channels in the porphyry, possibly being derived from the same source as a differentiation product. The term "Laurentian" has been used during the past to include many rocks such as gneiss, granite, etc., the age relationships of which were not always known. The granite, syenite, etc., of the Swastika area were first grouped as Laurentian, but field work during the past year has proved some of these rocks later in age than the Timiskaming series and older than the Cobalt series. The gold-bearing veins occur in the Keewatin, Timiskaming, and a later intrusive (feldspar-porphyry), but not in the Cobalt series. The light-colored intrusives are probably of the same age as the Lorrain granite in the Cobalt area, while the syenite, granite and feldspar-porphyry may be facies of a plutonic rock underlying the whole area.

The International Coal and Coke Co., operating at Coleman, Alberta, in March paid a dividend of one per cent.; total amount $30,000.

The Standard Silver-Lead Mining Co., with a silver-lead-zinc mine situated near Silverton, Slocan Lake, British Columbia, on March 10 paid its customary dividend of 2½ cents a share on its 2,000,000 shares, or $50,000. The total paid since the first dividend was declared in April, 1912, was $1,225,000 on a capitalization of $2,000,000.

*"Geology of the Kalgoorlie Goldfields," by Malcolm Maclaren and J. Allan Thomson. Mining and Scientific Press, 9th August, 1913, p. 232.

THE KIRKLAND LAKE EXPLORATION, LIMITED.

This company is organized with a share capital of £150,000, divided into 150,000 shares of £1 each. 50,000 shares were advertised for issue at par on January 28, 1914.

The following is taken from the prospectus published by the company:

"This company has been formed with the objects mentioned in the memorandum of association and in particular to carry on exploration work in the Kirkland Lake area, Ontario, in the Dominion of Canada. The company will obtain the opinions and reports of experts and others as to the mineral deposits, with the view of acquiring a limited or absolute interest in lands or claims suitable for mining development, of forming subsidiary companies to work the same, and also of acquiring interests in companies operating in the Kirkland Lake area.

"The Kirkland Lake area is in the district of Timiskaming, Province of Ontario, Canada, and is about 400 miles north of Toronto, the cobalt silver district being about 60 miles south, and the Porcupine gold district about 60 miles northwest.

"The Kirkland Lake area is a comparatively new mining field. About eighteen months ago the discovery of rich gold on certain claims in this area attracted considerable attention amongst men interested in mining in Northern Ontario, and since then many veins have been disclosed. Shafts have been sunk on a number of these claims, and several properties are now being actively developed.

"As evidence of what is believed to be the value of this new gold-mining area, it may be mentioned that the £1 shares of the Kirkland Lake Proprietary, Limited, are quoted in the market at a considerable premium.

"This company will be one of the earliest in the field, and it is anticipated that by prospecting, obtaining options on likely claims, proving them, and forming subsidiary companies to develop and work the same, substantial profits should be earned.

"The selection of claims will be undertaken upon the advice of a mining engineer who is already in the district. The company are also fortunate in having as a director Dr. F. H. Hatch, who has for many years been consulting engineer to an important group in the Transvaal.

"The Kirkland Lake Proprietary, Limited, has the right to nominate a director to the board of this company.

"Under the contract below mentioned the Anglo-Spanish Trust, Limited, has agreed with this company to pay, discharge, and indemnify this company against all expenses whatever in relation to this company down to the first general allotment of shares other than brokerage, and to advertise and circulate this prospectus, and in consideration therefor the Anglo-Spanish Trust, Limited, is to receive from this company £5,250 in cash and a call option on 100,000 of the unissued shares at par up to the 31st December, 1914, and in the event of such option being exercised to the extent of at least 50,000 shares within such period then an option up to the 31st December, 1915, at par on the balance of the 100,000 shares. None of the shares of this issue have been underwritten and, therefore, with the exception of the sum of £5,250 payable to the Anglo-Spanish Trust, Limited, in respect of the preliminary expenses, the whole of the moneys subscribed will be available for working capital and the general purposes of the company.

"The directors of the company are: Lieut.-Col. Chas. Hyde Villiers, Roydon Hall, Tonbridge, Kent, Director, Magadi Soda Company, Limited; George Cornwallis-West, J.P., Pinners Hall, London, E.C., Director, Cordoba Copper Company, Limited; Dr. Frederick Henry Hatch, M. Inst. Min. Met. and M. Inst. C.E., 34, Bishopsgate, London, E.C., Consulting Mining Engineer."

BURNSIDE CLAIMS.

Mr. H. H. Johnson, in a report, made for the Kirkland Lake Proprietary Co., on the Burnside claims, Kirkland Lake, says, in part:

"The property consists of three claims, Nos. L. 1821, 1822, and 1823, in extent about 90 acres, the first-named being situated in the Lebel Township and the two last in the Teck Township in the Kirkland Lake Goldfield, Ontario, Canada. The elevation is about 950 feet above sea level; the claims are bounded on the north by the Tough-Oakes mines, and Gull lake approaches near to the eastern and southern boundaries. The main line of the Timiskaming and Northern Ontario Railway runs within five miles of the property, the nearest station being Swastika, distant some six miles by good wagon road. Telephone communication is also established. Trains run daily between Swastika and Toronto, the capital of the Province of Ontario, connecting also with the main lines of the Grand Trunk Pacific and Canadian Pacific Railways; the time occupied between the capital and Swastika being about 20 hours. The claims are situated in the Timiskaming series, consisting of conglomerates, quartzites, and greywackes, which are generally greatly uptilted, and which are underlain by the Keewatin greenstones. Post-Timiskaming intrusions of feldspar porphyry are prominent, from which quartz veins appear to have been derived, these latter tending to follow the bedding planes or schistose partings in the sedimentaries. The quartz veins are in general the principal gold-carriers and are usually well mineralized. Several veins have been opened up on the surface by trenching, and at the northeast corner of Claim No. L. 1823 a vertical shaft (No. 1) has been sunk to a depth of 88 ft., from the bottom of which a crosscut has been driven 120 ft. across alternating conglomerates and greywacke, in a direction N. 35 deg. W., and at a distance of 80 ft. from the shaft the crosscut has intersected a quartz vein striking nearly N. 80 deg. W. and dipping 46 deg. south.

"Samples of this vein gave the following results:—

Location of sample.	Width, in.	Assay Gold, dwts.
*In back of crosscut	4	75.4
†3 ft. down on west side of crosscut	7	181.0
5 ft. down on west side of crosscut	2.5	306.0
In foot of crosscut, west side	3	170
Average	4.1	172.5

*3 or 4 inches of porphyry on either side.

†Includes 4½ in. of porphyry.

"Bulk samples from this vein, of 841 lb. quartered down, assayed 218 dwt. A further sample taken across 36 in. of vein-stuff and foot-wall and hanging-wall conglomerates assayed 137.6 dwt. Owing to a small inflow of water and the absence of any facilities for handling it at the moment, no driving has been done on this vein, and the water has been allowed to rise halfway up the shaft, while the labor force available has been concentrated in trenching on other veins before the winter snow prevented further surface operations. Some 800 ft. south of No. 1 shaft, No. 9 vein has been exposed for a

distance of 220 ft. in an east and west direction; the values on the surface averaging 22 dwt. across 7.3 in. This vein is in identical schistose conglomerates to the Tough-Oakes, and it may reasonably be expected that further work below the surface will open up good values. Further west and near the western boundary of No. 1822 claim are two parallel veins numbered 6 and 7; the former has been exposed for 40 ft., samples averaging 30.9 dwt. over 8 in. of quartz; the vein looks strong and carries visible gold right up to the boundary of the Sylvanite claims adjoining on the west. No. 7 vein, which is found some 60 ft. south of No. 6, is also small, but contains coarse gold, the average value being 10.6 dwt. over 17 in. A bulk sample of 490 lb. of ore from this vein, quartered down to 20 lb., assayed 9 oz. 12 dwt. per ton. The situation of the property renders it specially suitable for efficient working, being on the Government road to the Tough-Oakes mine; labor generally is of good quality and plentiful, and plentiful supplies of timber are at hand. Work can readily be carried on underground the whole year round, and the conditions are healthy in the extreme.

"I beg to place before you the following recommendations:

Recommendations.

"1. The sinking of No. 1 shaft to the 200 ft. level, at which point it should cut the vein already encountered on the first level. 2. Driving both ways on the above-mentioned vein from the first level crosscut in No. 1 shaft. 3. Raising from the first level crosscut on the vein to surface to assist ventilation. 4. Sinking of a shaft on No. 9 vein to a depth of 100 ft. and drifting along the vein at that level. 5. Sinking of a shaft on either No. 6 or 7 vein to a depth of 100 ft., connecting both veins at that level by a crosscut and simultaneous drifting on both. 6. Further exploratory work on the surface in the spring, which will probably be the means of locating further veins in this region.

Conclusions.

"1. The situation of the Burnside claims in the Kirkland Lake district renders them of great value owing to their adjoining the Tough-Oakes mine on the one side and the Sylvanite on the other, and being in the same identical geological formation. 2. Several veins have been opened up on the surface carrying good values in gold. 3. The deepest work, in No. 1 shaft, has disclosed the richest ore, thus pointing to the advisability of continuing work in depth. 4. The conditions for working are good, the claims being readily accessible, and mining can be carried on throughout the whole year without trouble due to climatic changes. 5. There is every indication of the continuity of the veins in depth, and development should be rapidly pushed forward. 6. Indications at present point to the likelihood of the Burnside developing into a mine of similar importance to the Tough-Oakes."

THE COPPER HANDBOOK.

The new Copper Handbook describes 159 active Canadian copper mining companies, the descriptions being included in the first part of the volume with those of the United States and Mexico. Most of the Canadian properties are naturally in British Columbia, but the geographic index shows that Manitoba has one, New Brunswick two, Quebec eight, Nova Scotia nine, Yukon eight and Ontario 37, while Newfoundland has 12.

This seems a small number considering the very many known copper prospects of British Columbia, but it must be remembered that the 94 companies described as British Columbia concerns embrace only the active mines of the Province, and that many owners of dormant mines and lesser prospects have not responded to Mr. Weed's request to send information to the Copper Handbook. It is hoped the next edition will be more generously supported, to the end that capital may be attracted to the development of the undoubtedly great copper resources of the Province.

It is of local interest to note that a very full description of the Granby Consolidated covers five pages and has a full but concise account of the new holdings of the company, its finances, geology, smelting practice, costs, etc., and that a favorable future is prophesied for this corporation. As Mr. Weed has personally visited practically all the mines of the Sudbury, Rossland, Boundary, Kamloops, Howe Sound and Vancouver Island districts in the course of his professional work, the descriptive matter concerning Canadian properties is authentic and not merely a compilation as in former editions of the work.

An interesting feature of the book is the section devoted to Copper Statistics and covering every feature of the industry in 47 pages of tables and charts. A list of the 325 leading copper mines of the world, tabulated according to their 1912 and 1913 production, is headed by the Anaconda Copper Co., with Rio Tinto fourth, Cerro de Pasco eighth, and Canada's largest producer, the Granby, in the twenty-third place.

NIPISSING.

As anticipated by many Nipissing Mine directors dropped the extra 2½ per cent. dividend paid since 1909, only declaring the regular quarterly 5 per cent., payable April 20. The financial statement as of March 16 shows cash, $737,670; bullion in transit, $168,832; bullion and ore at mine, $193,621; total, $1,100,123.

The course of the company's production, together with the falling cash surplus in recent months, has indicated that a cut in the dividend was inevitable.

The movement of Nipissing's cash and bullion surplus during the last nine months of 1913 was as follows:

Date.	Cash surplus
March 16, 1914	$1,100,124
Dec. 31, 1913	1,244,000
Sept. 30, 1913	1,384,000
June 30, 1913	1,484,000

The Hedley Gold Mining Co., operating the Nickel Plate group of gold mines in Similkameen district, British Columbia, has declared a quarterly dividend of 3 per cent. and a bonus of 2 per cent. on its issued capital of $1,200,000, making a total distribution of $60,000.

The Granby Consolidated Mining, Smelting and Power Co.'s first quarterly dividend in 1914 was of 1½ per cent., or a total of $224,977.73 for that period. Granby Co. has now paid about $5,000,000 in dividends, or about one-third of the par value of its issued stock.

The Consolidated Mining and Smelting Co. of Canada, Ltd., with mines and smeltery in British Columbia, has declared Dividend No. 12, of 2 per cent., for the quarter ended March 31. The total of this distribution is $116,088. This is the fourth consecutive quarterly dividend payment of a similar total amount.

THE MILL AND METALLURGICAL PRACTICE OF THE NIPISSING MINING COMPANY, LIMITED*

By James Johnston, Cobalt, Ont.

(Continued from March 15 issue)

Battery.

The mortar block foundations, consisting of 846 cu. yds., are of concrete 81 ft. long and 6 ft. wide on top, with the anchor bolts set in on an incline; and facilities are provided for dropping the bolts so that a mortar may be easily removed. The battery posts are 12″ x 26″ and 24″ x 26″ set in cast iron shoes, rubber ¼″ thick being placed between shoes and concrete. The mortars are Fraser & Chalmers, No. 161 type for rapid discharge, weigh, with steel liners 12,410 lb. each, and have rubber ¼″ thick placed between them and the concrete.

There are forty 1,500 lb. stamps, five to each camshaft, and the order of drop is 1, 3, 5, 2, 4 with a set height of 8″ at 96 drops per minute. The camshaft is of 7″ diameter, of the Blanton fluted type, and the stems are 4″ in diameter. The height of discharge is maintained at 1″ above the level of the dies.

The different parts of the stamps weigh when new as follows:

Swedish iron stem, 4″ dia. x 16 ft. long	681 lb.
Cast steel tappet, 10⅛″ x 14″, key and gib...	190 lb.
Cast steel head, 9½″ dia. x 24″ long	41 lb.
Forged chrome steel shoe, 9¼″ x 12″.....	254 lb.
	1,537 lb.

Each battery of ten stamps is driven by a 40 h.p. motor running at 575 revolutions per minute. The motor is placed directly under the ore bin and drives with a 12″ wide rubber belt to the countershaft placed below the feeder and mortar floor. This countershaft runs at 113 revolutions per minute and is placed at 11′ 7″ centres from the motor. Drive from countershaft to camshaft is by a 12″ wide x 8 ply belt to a 6 ft. diameter camshaft pulley. The operation of the various battery motors is controlled by individual switchboards arranged side by side, under the battery ore bins.

The ores from the Cobalt district are very hard and tough as may be seen by the figures given in the following table:

Battery Screens and Crushing Duty.

Stamps operation.	Mesh per in.	Size of Wire in.	Aperture in.	Stamp duty per 24 hr.
		Early Practice.		
20	8 x 8	0.048	0.077	5.7 tons
20	2 x 4	0.072	0.178	
		Present Practice.		
20	3 x 3	0.072	0.261	6.7 tons
20	2 x 2	0.092	0.408	

Screen Pulp Grading Mesh.

+8	+20	+60	+100	+150	+200	—200 Sands	—200 Slimes
25.1%	29.8%	17.89%	5.93%	1.93%	1.65%	4.28%	12.43%

The battery screens are 18″ deep and are made of high carbon crucible cast steel, double crimped, wire cloth. This quality of screen has been in operation now for three months, and shows practically no signs of wear.

The chilled cast iron liners, 1″ thick, of the mortars last but 30 days, while Manganese steel liners last as long as 165 days. The life of the shoes is 105 days, equal to 703.5 ton days.

The power necessary to drive each 10 stamps is 23 k.w.

A dilution of about seven of solution to one of ore gives the best results in the mortars whilst crushing.

The battery feed tank is 20 ft. in diameter and 15 ft. deep; it contains 147 tons of solution, and the bottom of the tank is 8′ 6″ above the top of the mortar. The main pipe between tank and batteries is 6″ diameter, with flanged connections for pipes, fittings and valves, to enable the easy cleaning of pipes.

On account of the preliminary desulphurizing treatment which is given to the ore before it is cyanided, it is necessary to crush in the battery with a 0.25% caustic soda solution, having no cyanide in it; 5 lbs. of lime are added to each ton of ore, as it is placed in the battery ore bin; this is necessary for the settlement of the slime in the collecting tanks, enabling a clean solution to be returned for recrushing and classification purposes.

Classification and Fine Grinding.

The importance of extremely fine grinding was clearly demonstrated in the early experiments, and further experimental work confirmed this. The grinding was then considered on the basis, that all the ore (metallic silver included) had to be ground to pass a 200 mesh screen; that this product had to be classified to take out the —200 mesh sands for regrinding and further classification, until there remained only about 15 to 20% sand, much finer than —200 mesh, in the product delivered to the cyanide plant.

The need for an accurate method to determine the percentage and grading of these sands and slimes was soon apparent and resulted in the use of a small system of cone classification to replace the earlier practice of hand panning. Three tin cones, respectively 5½″ diameter, 7″ diameter and 10½″ diameter at the top, were arranged in series for these tests with a water dilution tank, 8″ diameter by 8½″ deep, so placed as to give a 6″ head. The pulp to be tested is slowly fed into the first and smallest of this series of cones and the different grades of sands and slimes are recovered from each cone. As this device worked fairly accurately, two of them were installed, so that a constant check could be kept on this work, as the final residues from the cyanide plant almost invariably rise or fall according to the efficiency of the grinding.

As an instance of this, when the mill pulp is delivered to the cyanide plant it shows a grading test as follows:

3% to 4%.....+200 mesh
30% to 35% sands in .....—200 mesh

The final residue after cyanide treatment assays about 3.50 oz. to 5.00 oz. silver per ton.

When the pulp shows grading test as follows:

0.5% to 1.0% .....+200 mesh
15.0% to 20.0% sands in.....—200 mesh

the final residue after cyanide treatment assays under 2.00 oz. silver per ton of ore.

The necessity of such fine grinding of the ore accounts for the large tube mill and classifier capacity as compared with the number of stamps operating. The classification is obtained with one Drag classifier and 6 Dorr duplex classifiers, the slime overflow lips of which were raised 5″ to give greater opportunity for the settlement of the —200 mesh sands, and to prevent them from being carried over with the fine slimes as they overflow to the cyanide plant.

*Extracts from paper presented at Annual Meeting, C. M. I., Montreal, March 4, 1914.

Tube Mills.

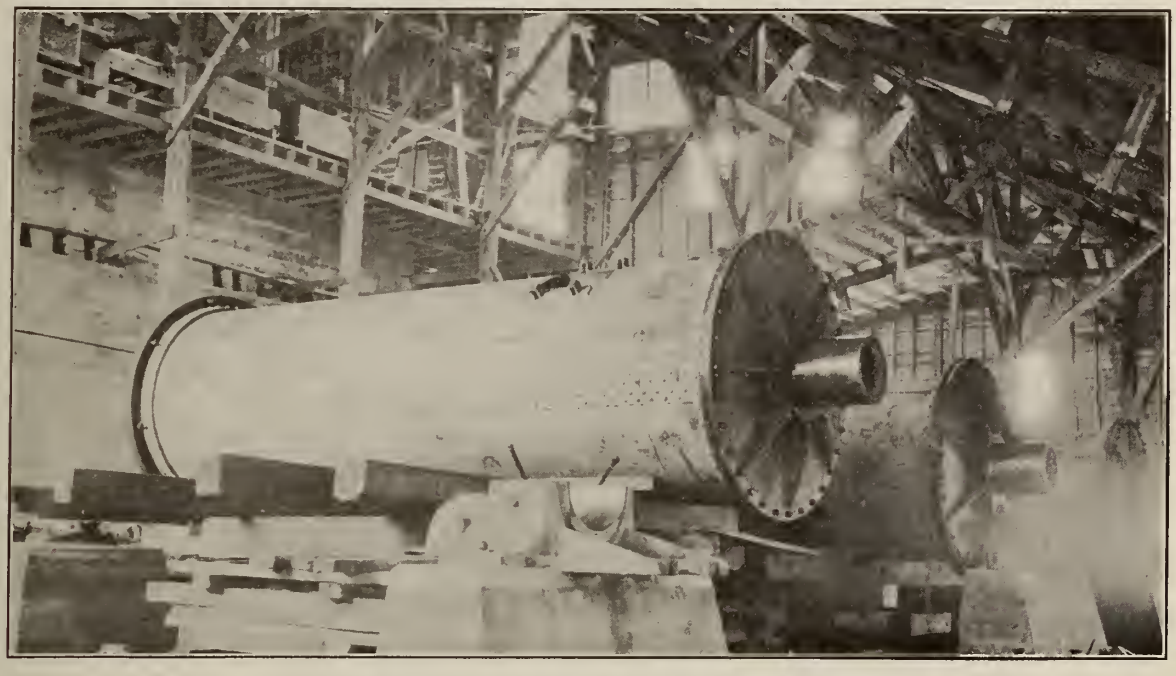
The four tube mills are 6 ft. in diameter x 20 ft. long with end bearings 20″ diameter x 18″ long. The feed end bearing or gudgeon is fitted with a removable, hard iron, spiral grooved liner, 9″ inside diameter, to the outside of which is fastened the feeding device, consisting of a cast iron spiral scoop, inside dimensions of which are 6″ x 6″. This scoop picks up from a wooden box the pulp which is to be fed into the mill. The discharge and gudgeon has a chilled cast iron screen with ½″ diameter holes in it to retain the pebbles inside the mill. The shell of the mill is 9-16″ thick and Silex bricks 4″ thick are used for inside lining. There are two 18″ x 18″ manholes. The mills run at 25 revolutions per minute and are driven by pinion and spur gears of 15 and 100 teeth with 3½″ pitch and 12″ face, from a countershaft to which the 96″ diameter x 19″ face driving pulley is connected through a quill and friction clutch. The weight of the 2 cast steel heads, 1⅝″, is 12,000 lb. The total weight of each mill is 45,375 lb.

The mills are arranged parallel to each other and at right angles to the battery, the driving, shafting and gears being arranged at the feed end of the mill. Each mill is driven by a 125 h.p. motor running at 580 revolutions per minute, the motor pulley is 28″ diameter and 19″ face, and is belted to the 96″ diameter pulley on the countershaft. Two of the mills, with their motors, are placed with 19′ 4″ between centre lines the other two with 24′ 4″ centres, the drive being transmitted through 8-ply endless, stitched, rubber belting, 18″ wide.

This system of driving has proved very satisfactory; none of the belts after 12 months' continuous service having yet been cut or spliced. The power necessary to drive each mill, when they are carrying a pebble load which is about 2″ to 3″ above the centre line of the tube mill, is 85 k.w. The mills operate in a closed circuit, two of them taking the classified pulp from the battery and the other two taking the classified fine sands for regrinding. The two coarse grinding tube mills are charged with flint pebbles and a hard ore pebble, selected from the hardest portion of the run of mine ore; the average consumption of pebbles in these two mills, per ton of ore crushed, is about 1.8 lb. of flint pebbles and 2.0 lb. of ore pebbles. The two fine grinding tube mills are charged with flint pebbles only and the average consumption per ton of ore crushed is about 4.3 lb., thus giving a total consumption of 6.1 lb. of flint pebbles and 2 lb. of ore pebbles.

The best grinding efficiency is obtained in all mills when the pulp carries about 40% of solution.

The following data afford the particulars of the feed and discharge of the mills when operating on the basis of 244 tons per day:



Tube Mills and Stamp Mill Foundations, Nipissing Mill.

Tube Milling Data.

	Two Tube Mills on coarse grinder, fed by Duplex Classifiers, each Classifier handling about 61 tons in 24 hours.				Two Tube Mills on regrinding, fed by 2 Duplex Dorr Classifiers and 1 drag Classifier.			
	No. 3 Mill.		No. 2 Mill.		No. 1 Mill.		No. 4 Mill.	
Mesh	Head Sample or Feed to Mill.	Tail Sample or Discharge.	Head Sample.	Tail Sample.	Head Sample.	Tail Sample.	Head Sample.	Tail Sample.
+20	57.02%	5.8	58.89%	2.90	2.12	0.4	4.46	1.44
40	14.7	5.58	14.74	4.96	1.90	0.92	3.86	0.70
60	5.17	6.04	6.82	7.6	2.44	1.00	5.38	1.56
80	4.26	6.24	4.19	8.96	5.06	7.77	6.60	3.80
100	4.73	9.2	4.10	11.32	12.06	2.74	11.34	10.40
120	3.48	7.6	2.47	6.96	11.14	6.46	2.40	9.80
150	0.30	0.40	0.27	5.0	1.42	0.4	3.92	0.62
+200	3.44	6.86	1.43	8.9	18.40	12.90	18.0	4.38
—200 Sand	5.21	19.30	5.28	18.11	41.19	38.27	39.94	38.44
—200 Slime	1.67	32.18	1.58	24.73	3.11	28.23	3.02	28.16
Totals	99.98	99.20	99.77	99.44	98.84	99.09	98.92	99.30

The battery pulp is conveyed to and classified in the first set of four classifiers; the slimes overflow direct to the slime collecting tanks in the cyanide plant and the oversize from all four is delivered into the two coarse grinding tube mills.

The above table shows the grading of the product fed into these mills.

The discharge from the coarse grinding tube mills then flows into the second set of two Dorr classifiers, where it is again separated into slimes and sands, the slimes overflowing into the same slime collecting tanks and the sands are elevated to the two fine grinding tube mills. The above table shows the grading tests of these mills.

The discharge from the fine grinding tube mills flows into the drag classifier and the above set of two Dorr classifiers; the slimes overflow to collecting tanks and the sands are returned for further fine grinding.

In this system all sands and metallic silver are kept in a closed circuit until they have been ground fine enough to overflow the weirs of the classifiers; and, on account of the fine product desired, the weirs were raised and the capacity of these standard classifiers was very much reduced so as to give more opportunity for settlement.

The best classification is obtained when working with a dilution of about 8% solution to 1 of ore, and frequent sampling of the slime overflow is necessary to ensure that too many fine sands are not passed over to the collecting tanks.

Tonnage and Values.

All the ore is weighed into the mill over a Fairbanks registering scale, a simple and effective method of recording the tonnage. These weights are then checked against the usual method of specific gravity tonnage determination, made in the slime plant, and after a seven months' mill run there was only a variation of one-eighth of 1% between the two methods.

Many moisture determinations have been made on a large scale on the ore entering the mill, and the average shows 1.5% moisture during the summer months and 2.0% during the winter months.

The head assay value is taken by an automatic sampler, the slotted pipe of which cuts vertically through the mill pulp as it enters the cyanide plant, about every six minutes. The ore in the pulp at this stage has all been crushed to finer than 200 mesh in a caustic soda solution, with no cyanide; hence this ensures as correct a sample as it is possible to get. The residue sample is taken while the filter box is discharging, a number of cuts of the pulp being taken from each discharge opening and then all mixed together. On the basis of the above determinations a check has been kept on the silver bullion produced, and, although a final cleanup will not be taken until the end of the year, more silver is already being produced than the commercial assay of the ore calls for, which warrants the consideration of the difference between the commercial, and the corrected, assay value of the ore.

The pulp as it flows from the classifiers, that are in the crushing department, into the cyanide plant has a dilution of 11 solution to 1 of dry slime.

The launders around the mill are all built of 2″ dressed dry white pine. The one from the battery to the Dorr classifier carries a pulp ground to pass two meshes to the inch with a water ratio of 7 to 1; this is 9″ wide by 7½″ deep and is placed on a 15% grade; the bottom of this launder is lined with a chilled, cast iron liner which is ⅝ of an inch in thickness, the wear and tear on this plate, which has been in operation for twelve months, has amounted to ⅛ of an inch.

The launder carrying the oversize from the classifiers to the tube mill has a pulp diluted to 40% for tube mill grinding; this launder is 4″ wide by 8″ deep and the bottom is lined with 3-16 of an inch sheet iron. The launder feeding the coarse grinding tube mills has a 30% grade; the one feeding the fine grinding tube mill has a 23% grade. The launder carrying the discharge from the tube mills to the lower classifiers is placed on a 6½% grade, is 6″ wide by 12″ deep, and is lined with 3/16 of an inch sheet iron on the bottom; the tube mill pulp is diluted with a ratio of about 10 to 1. The launder carrying the overflow over all the classifiers to the slime collecting tanks has a 4.7% grade, is 9″ wide by 8″ deep, and carries an all-slime product diluted to about 11 to 1.

The overflow from the slime collecting tanks runs to the lower battery solution tank on a 5.5% grade and is 9″ wide by 12″ deep.

The launders which transfer slimes into any cyanide treatment tank, and which take delivery from a 7″ centrifugal pump of 1,000 gallons per minute capacity, are 22″ wide by 18″ deep and have a 3.1% grade; they carry a thickened liquid with 1 of slime to 1½ of solution. The other launders which transfer slimes into cyanide treatment tanks take delivery from a 4″ centrifugal pump which has a capacity of 230 gallons per minute, and these launders are 11″ wide by 12″ deep and have a grade of 3.1; they transfer a pulp of the same ratio, namely, 1½ of solution to 1 of slime. The launders which take the decanted solution from the cyanide treatment tanks are 19″ wide by 15″ deep and have a 1% grade.

Cyanide Plant.

The description of the cyanide plant was reprinted in the Feb. 1 issue of the Canadian Mining Journal, pp. 99-101.

Electrical Power.

In a mill where the average power costs represent about $4,000 of a total working cost of about $28,000 per month, it was advisable to arrange the installation so that as high an efficiency as possible might be obtained. The installation was so planned that each machine should be of the correct size to carry its load, and thus, obtain the highest efficiency and power factor. As a measure of the success obtained in this respect it may be stated that the power factor of the mill averages 82.5%.

Cost of Electrical Installation.

Motors, switchboards, wiring, etc. and labor	$26,532.86	
Electric lighting of mill	1,635.61	
		$28,168.47
Extra wiring, poles, etc. for the Peterson Lake pumping plant located about 1,560 feet from the main buildings		250.00
		$28,418.47

Power is received at a pressure of 11,000 volts and is transformed to the working pressure of 550 volts in a sub-station situated 150 ft. from the main building. A 3-phase overhead line from this sub-station feeds the

main switchboard, which is placed on the tube mill floor, this position being about the centre of power consumption. From the main switchboard, feeders are carried, through suitable links and disconnecting switches, to the various motor control boards.

The motors are all 3-phase, 550 volts, 60-cycle, Canadian Westinghouse type G.M. machines. The "squirrel cage" rotor was selected on account of its ruggedness and simplicity. The average full load efficiency and power factor for each class of these machines was found after careful testing to be:

Original Motor Power Distribution.

Washing Plant—Operates 6 Days of 9 Hours Each, per Week.					
1	40 h.p.	Motor	850 Revs. per min.	Main drive	
1	15 h.p.	Motor	565 Revs. per min.	Aerial tramline	
1	30 h.p.	Motor	720 Revs. per min.	Surface hoist	
1	10 h.p.	Motor	900 Revs. per min.	Elevator hoist	= 95 h.p.
Battery—					
4	40 h.p.	Motors	575 Revs. per min.	Battery drive	
1	40 h.p.	Motor	575 Revs. per min.	Return solution pump	
1	10 h.p.	Motor	1120 Revs. per min.	Elevator ore bin	
1	5 h.p.	Motor	1800 Revs. per min.	Conveyor belt	=215 h.p.
Tube Mills—					
4	125 h.p.	Motors	580 Revs. per min.	Mill drive	
1	5 h.p.	Motor	1120 Revs. per min.	Lower classifiers	=505 h.p.
Treatment—					
1	125 h.p.	Motor	485 Revs. per min.	Agitating tanks	
1	35 h.p.	Motor	855 Revs. per min.	Circulating slime	
1	20 h.p.	Motor	690 Revs. per min.	Circulating desulphurizing	
1	20 h.p.	Motor	690 Revs. per min.	Alkali pump to cyanide tanks	
1	2 h.p.	Motor	1800 Revs. per min.	Experimental plant	=202 h.p.
2 Filters—					
1	80 h.p.	Motor	870 Revs. per min.	Filter Box—Cyanide	
1	35 h.p.	Motor	855 Revs. per min.	Filter Box—Alkali	
1	10 h.p.	Motor	570 Revs. per min.	Vacuum pump cyanide	
1	1 h.p.	Motor	1200 Revs. per min.	Hydraulic valves	=126 h.p.
Precipitation—					
1	10 h.p.	Motor	570 Revs. per min.		= 10 h.p.
Water Service—					
1	25 h.p.	Motor	1800 Revs. per min.	Centrifugal pump	= 25 h.p.
					28 Motors=1178 h.p.

Cost of installation $24.15 per h.p. of Motors.

in steel conduits. The average total load on the mill amounts to 690 k.w. The recording wattmeter registers a variation of less than 5% from this figure from day to day, on the day load.

Efficiency of Motors.

For 125 H.P. Class.	Efficiency=91%	Power factor 89.6%
For 80 H.P. Class.	Efficiency=89%	Power factor 88 %
For 40 H.P. Class.	Efficiency=88.3%	Power factor 86.9%
For 35 H.P. Class.	Efficiency=87.5%	Power factor 83.6%
For 15 H.P. Class.	Efficiency=85.8%	Power factor 85.5%

Each motor is provided with a control panel upon which are mounted a 3-pole, automatic, oil circuit breaker and auto starter, fitted with no-voltage release, ammeter, and a serviceable inverse, time-limit relay, in the form of fuses, and a double pole, spring tumbler switch, inserted across the circuit breaker, tripping coil terminals. This relay is used for starting duty only, and, in conjunction with the no-voltage release on the auto-starter, renders the gear practically "fool-proof." The motor control panels, 1′ 6″ wide x 6′ 0″ high, are grouped to make switchboards of convenient size, and are so placed that the machines which they control may be easily seen from them. The main switchboard is equipped with an automatic, 3-pole oil circuit-breaker, controlling the entire mill supply, a volt-meter, ammeter, integrating wattmeter, and a graphic recording wattmeter. The wiring of the graphic wattmeter is so arranged that a record of either the total mill load, or the load of any individual motor, may be obtained. All wiring within the mill is carried

Much credit is due to Mr. W. H. R. Burrows, the company's resident engineer, for the excellent installation and high efficiency obtained in this power service.

In conclusion, the writer wishes to acknowledge the encouragement and assistance of Mr. R. B. Watson in the many difficulties that developed before all the details of the system and installation were satisfactorily worked out. Thanks are also owing to Mr. Watson for permission to publish the data in this paper. The writer also desires to pay tribute to the good work done by Mr. Hamilton and Mr. Denny, in the course both of the experimental work and of the starting of the mill.

ELECTRICAL TRAINING FOR MINING ENGINEERS*

By Alexander Anderson.

In common with many other industries the science of coal mining is advancing, and the mining electrical engineer must extend his knowledge to cope with the new conditions which are constantly arising. Indeed, were it not for this fact, there would be no necessity for this Association and no occasion for this address. Experience has taught us, however, that the necessity exists and is every day becoming more apparent and more real. I have said on former occasions before members of this association that no man can rely on his own experience, however wide. It must be leavened by the experience of others if steady progress is to be made and maintained. I admit progress may sometimes be made single-handed, so to speak, but it is too slow for this age. Conditions have altered, and we must be prepared to meet them. To do so, I am prepared to give of what time and energy I may have at my disposal in trying to further an organization which has for its object the promotion of the study of electrical engineering in its relation to mining. As a matter of fact, the need for study is advancing, not by degrees, but by leaps and bounds. If the modern colliery electrical equipment is to be run and maintained in not only a safe condition, which is the first essential, but a condition that will satisfy the owner and justify its existence as an economical aid to mining, the day for the engineer who has only a little elementary knowledge of electrical machinery is gone, and the sooner he realizes the fact the better, not only for himself, but for all those associated with its use.

Our late president (Mr. Maurice) said in one of his addresses that "English working people on the whole are not much given to self-improvement." I say so much the worse for the people and so much more the need for those who see the necessity for it to bestir themselves to try to cultivate that something which is wanting in the people to whom he refers. If we are to keep our place amongst the nations which our good fortune and energy have given us, it will be done only by every individual realizing his responsibility, not only to himself, but to the country of his birth. This association has found there is a great deal of truth in Mr. Maurice's remarks, and I would ask you now to give them the attention they deserve and try to find out ways and means of arriving at the solution of the problem, because it is a problem and must be treated as such. Some of our branches, in the last two years, realizing the necessity of facing this question, have met with some success. They have organized lectures in colliery centres, enlisted the sympathy of resident colliery officials, and secured lecturers from within and without their own membership. These meetings have been made very popular and interesting with the aid of lantern slides, illustrating electrical mining appliances. When I tell you I have myself seen an audience of over 300 people—some travelling by train distances of over 20 miles—I think you will agree there is a great field open and quite ready to be tapped if proper enthusiasm is shown and the sympathies of the people enlisted. I commend this method as a stimulus to the ambition which is in every man, latent, perhaps, but requiring only to be stimulated in order to be awakened. There must be other ways of encouraging the progress of this great work, and I feel convinced that, given the attention which is both due and imperative, we may look forward to this association filling up the "fault," if I may so speak, in the path of progress.

The average engineer has not a great deal of time during the day to think or study. It is work that is expected of him, but the man who gives up some of his spare time to study the science of his profession will find that he gets back the time spent with compound interest. Nearly everything he does will have added interest. Knowledge is not only power, it means also personal respect. For instance, what can a man know about the power factor of a three-phase line unless he has studied the theory of alternating currents? How many men there are in charge of "plants" who have never given a thought to what happens to a line that is left in circuit when an "earth" develops on the other! A very little knowledge of theory makes both those questions interesting, but without the theory they may mean little or nothing until something happens. Electrical plant has now become so complicated that, to run it successfully, complete knowledge of its construction and characteristics has become not merely desirable, but essential.

As I have already said, things are moving by leaps and bounds, and it is very difficult to get really first-class men. Why? Many young men who enter the profession do not seem to realize the necessity for beginning their theoretical education at once, but rely solely on what years of practical experience may teach them. They do not seem to grasp the fact that a smaller number of years combined with some hard study would make them the competent and efficient professional men that all should aspire to become. If the latter course were adopted, I feel certain we would not have the same difficulty which to-day we meet with in finding reliable engineers amongst the younger men. Unreliable plant is very often the outcome of unreliable attention, not due to carelessness or laziness as some might think, but to the absence of technical knowledge in the matter of particular apparatus.

Everybody in or out of this association will agree there should be no room for anybody in the electrical world who does not know his work, but unfortunately, owing to the scarcity of the type of man we would all like to find, it is necessary sometimes to employ men who require a good deal of guidance where none should be required. What happens? High maintenance costs and sometimes irreparable injury to some apparatus or other. Unless a man is capable of "detecting" trouble in its early stages, or of seeing that his apparatus is kept in a condition calculated to avoid trouble, high maintenance charges may be expected. Indeed, this is common to all plant, but more particularly to electrical plant. A man who does not know his work is not only a menace to his employer, but a source of great trouble to the manufacturer. A man who understands his work can state his case, and by doing so at the proper time things can be straightened out; but the other type of man cannot, and because he cannot, saddles the blame on some other shoulders, prefacing his note, of course, by saying "It never was right." What we want is not

*Extracts from Presidential address, Association of Mining Electrical Engineers, Birmingham, October, 1913.

merely that "plant" should be "right" when it is placed, but that men who receive the "plant" are capable of knowing that it is "right."

I do not want, however, to lay the blame every time on the man in this unfortunate position, because in many cases, if he had had the opportunity of improving himself he would have done so, and this is our opportunity. Let this association, in the first place, show him the need, and then the way to improve himself in matters electrical. We are all accustomed to hearing an expression of opinion regarding the large number of rules and regulations that are laid down for our guidance, but I would ask—can we not do something ourselves to prevent the necessity for them? I think we can, and the elimination of the unreliable for the reliable engineer is the first step in this direction. The Rules and Regulations which exist to-day for our guidance require the latter type of engineer, and if we do not wish to court the necessity for further regulations we must do all we can to see those already existing efficiently executed. In doing so we are doing no more than may be expected of us. I think an engineer who values his reputation as such will see that they are carried out, and avoid getting himself and other people associated with him into trouble. To carry them out he must be energetic, and willing to spend a little of his time in order to become quite conversant with the class of practice permissible in mining. The present Electrical Rules are short and easily grasped by the alert enginer. To be alert in the true sense of the word the engineer must be a student, and the encouragement of studentship has always been the aim of this association. This encouragement has been shown by members of the different branches of the association, in the giving of prizes for papers of merit on electrical subjects which have been read from time to time.

As years go on we will see a steady development in the use of electricity as an aid to mining. Already we have collieries equipped which from the winding engine to the undercutting of the coal rely solely on electricity as the motive power, and this class of colliery is rapidly extending. What does all this mean? Electrical plant generating units of thousands of h.p. running at thousands of revolutions per minute, with their attendant condensers, and so on. Anyone will agree that to give machinery of this class the supervision it deserves requires no apprentice hand; the head and hands of the engineer are required. His work does not end here, however; units of this class are not controlled by means of the simple switchgear one can still see at the present time. We now find our engineer should understand the latest and best in switchgear, and all that goes to make up that extraordinary piece of apparatus. He must also be competent to select and calculate the size of his transmission lines, and it is just here that a great weakness is often shown. It is not uncommon to find 400 volts where one is entitled to expect 450.

Having selected his lines the engineer must turn his attention to his distribution gear. The tendency at the present time is to have this completely enclosed in cast iron with all interconnections made inside the casing. This is very effective and very safe. One is frequently struck, however, with the primitive housing given to underground switchgear. Nothing lends itself so readily to badly-kept apparatus as badly-designed housing. The average underground distributing station of the present day will compare badly with that of the future, when we may expect to see well-made walls and clean and even floors. The housing will be well lighted, as our successors will have learned what many of to-day evidently do not know, that plenty of light is essential to that degree of cleanliness which is demanded by either open or enclosed gear. Cables will enter and leave the station in a manner calculated to give one the impression that the engineer has an intelligent idea of where he means the cables to go, and not as we find too often now, the "bunching" process so rigidly adhered to as to suggest that this method is indispensable to well-installed lines. The engineer will have such a grasp of the necessity for complete and regular inspection of his lines, that he will see they are erected in such a manner as to make inspection not only as easy as possible, but also of some value when completed. He will realize that the leaving of road cables exposed to dripping water or buried in debris does not tend to economy, and that it is worth his while to adopt measures to give them that protection which the circumstances demand. Positions for sub-distribution gear will be chosen with due regard to accessibility, and a piece of apparatus hidden in the waste will not be tolerated. These appliances will get the place to which they are entitled, although one does not expect their housing to be of such a permanent nature as that of the main station. Although they are not of a permanent character it will be clearly recognized, however, that the first and last consideration in erecting electrical apparatus is safety. In damp workings especially, the importance of properly finishing off the ends of the cable will be recognized and all joint boxes will be well filled or made waterproof. Pumping and haulage stations will be well built and as well lighted as the circumstances demand. It will be recognized that this is not only essential for safety but is true economy. The motor attendant will not be expected to be the first to report signs of failure. This will be the duty of the engineer, who will keep a proper record of all motors under his charge, not only with regard to electrical tests but also in the matter of their condition mechanically. We have not many men to-day who are capable of looking after both the electrical and the mechanical side, but our future requirements, in my opinion, will necessitate all engineers combining both qualifications.

We have a difficulty at the present time in finding sufficient men who are able to do this. The engineer who recognizes that the majority of electrical breakdowns are due to inattention and dirt, will see that oil, grease and dirt are kept in their proper place, and that bolts which perform a useful function when tight, fail to do so when slack. If the insulation resistance is gradually falling, he will not wait until a "fault" develops, but will take steps to remedy the defect before it is too late. In doing so he will not only save himself much unnecessary trouble, but he will also save his employers money. Numerous as electrically driven coal-cutters are to-day, they will be still more so in the future, as the time is surely coming when little coal will be mined by hand. This will increase the work of the electrical engineer. I think the engineer should take some pains in educating motor attendants as to how apparatus under their charge should be handled, as it seems to me there is something wrong in placing apparatus worth hundreds of pounds in the hands of men who have little or no previous experience in their proper use. If more attention were

paid to the education of the motor attendant, less would be heard about the maintenance charges. One "shift" of incompetent handling may necessitate repairs the cost of which would pay the wages of an instructor for six months. In a colliery using a large number of coal-cutting machines, changes amongst those in charge will be of frequent occurrence, and a capable instructor employed for no other purpose than as a responsible party to see that every machine is being properly handled, would well repay the management that recognizes this necessity.

I may be accused of creating extra officials, but in mining, as well as in every other industry, circumstances have arisen which make competent supervision, if not absolutely essential at least desirable if we want the maximum of profit and the minimum of trouble. Everything is now being boiled down to either units of weight or units of time, making mathematical precision the golden rule to be learned and observed by all. To maintain this precision and keep everything working in harmony, our gear must be selected suitable for its work, and thus shall design and workmanship come to their own. With the growth of technical education this is now becoming more generally recognized, and I am optimistic enough to think the day is not far distant when this will be universal, at least in the electrical world. We will then see at our regular meetings those gentlemen whom we only meet to-day in a so-called commercial capacity, and I feel satisfied those meetings will prove of interest to them, a pleasure to us, and a profit to their employers.

THE ELECTRO-METALLURGY OF STEEL.

Mr. Woolsey Johnson in the March, 1914, issue of Metallurgical and Chemical Engineering says in part:

There are three roads along which future progress will be made in applying electricity to steel metallurgy. Fortunately, we can record some pronounced commercial success in each line, and have generally recognized facts of the past and present on which to base hopes of the future; we have the evidences of things seen for existence of things unseen.

The three present roads are as follows:

(1) Crucible cast steel or alloy steel making.

(2) Steel castings in foundry.

(3) Super-refining of hot steel for "tonnage" steel in a steel plant.

In the first, unquestionably is the largest margin of profit. But an examination of the process for making "tool" steel does not disclose any great lack of satisfaction among user and maker. Much bad steel is sold as tool steel, but a great amount of fine steel is made in crucible to satisfaction of maker, vendor and user.

Unquestionably there are innate points of superiority in the electric steel furnace over the crucible. These can be enumerated as follows:

(1) Decreased labor charge.

(2) Dispensing with crucibles.

(3) Increased thermal efficiency.

(4) Control of temperature and chemical conditions.

All these can be summed up in fact that size of unit could be increased at will. Under (4) we might point out that the reaction between oxygen and carbon dissolved in steel comes slowly to equilibrium and that so-called "dead-killing" done in crucible can be effected much more easily in the electric furnace, and that a dense ingot can be better obtained by electric furnace than by crucible.

If we consider the electric steel furnace for alloy steel we see that its control over reductivity profoundly affects the commercial conditions in dealing with easily oxidized elements, as manganese, chromium, etc.

If I were going into the electric stool steel business, I would choose some special new field like the production of steel for mine drills. Here the advent of small high-speed hammer drill has brought a necessity for a better grade of steel, selling, say, for 8 cents per lb. This would give the newcomer more of an even chance, especially as the purchasers would buy in large blocks and would be guided by technical advice.

In arguing pessimistically in all the above, I disclaim any intention of doing anything but pointing out the general great commercial inertia and friction that confronts this and every similar innovation. My conviction of the gradual commercial success of the electric tool steel furnace is no less strong even if I see clearly the forces opposing it.

Electric Steel Castings.

In the steel castings we have much greater chances for an immediate broad expansion of the electric steel furnace. The economic freedom is great. For instance, in every industrial centre there is a growing demand for steel castings from many consumers, and there is produced often by some people a large amount in the aggregate of steel drillings and turnings, "fins" from drop-forge bar plant, all of good chemical quality and all sold at a discount because of physical nature. Some of this contains oil enough to do all the pre-heating under which procedure the energy consumption would be reduced to 350 kilowatt hours per ton of product. Besides this there is often "off-peak" power that could be purchased from central stations for 7 mills to 9 mills.

Under such conditions it is perfectly possible to produce liquid steel suitable for castings for $26 per short ton; in fact this is an accomplished commercial fact. With a good-sized plant and especially favorable conditions it is quite probable that liquid steel could be made for $18 per short ton, and this is not the ultimate. The "baby" converter which uses a "high-silicon" low-phosphorus pig iron costing at an average of over $20 per ton has a serious rival in the electric furnace for production of smaller castings.

The quality of electric steel is high and its physical properties are such that with careful molding a higher percentage of merchantable finished castings can be expected. It must be realized that in any foundry careful planning of the molding work is a sine qua non, and the electric steel foundry should have ability equal to that of competing plant. Molding is at least 50 per cent. of the battle of the electric steel foundry.

We may even hazard the prediction that the open-hearth steel foundry has a potential competition in the electric furnace on large castings.

Tonnage Electric Steel.

In considering this subject we see that the legitimate hopes of the pioneers have been deferred. In apposition to this is the opposition to the electric furnace by the old-time steel men. This is a perfectly natural human feeling.

In the manufacture of tonnage steel it is natural to give this a first quick refining in the Bessemer or open-hearth furnace, pour the partially refined steel into the electric furnace, finish the refining there by use of a slag high in lime, allow reactions to come to equilibrium, the gases to pass off and the impurities to come to the top, and after this "dead-killing" is accomplished, to pour the metal into ladle. It was this accomplishment with the discovery of the "calcium-carbide" slag and

the practicalization of the "series arc" furnace that was the second great contribution of Paul L. T. Heroult to electro-metallurgy.

This electric process has given new life to the Bessemer converter, and there are those that see a "triplex" process, bessemerizing basic open-hearth treatment with final electric furnacing, as the process of the future. This may well be for certain large installations.

Certain it is that when operating in a large way on "duplex" process, the electric furnace can make steel of a superior quality at a cost slightly, if any, above the cost of that made by fire in a single operation. With the demand as pressing as it is now for "high-duty" steel rails, it is likely that the first marked commercial expansion in tonnage electric steel will be in the way of making a quality steel rail.

BOOK REVIEW.

IGNEOUS ROCKS AND THEIR ORIGIN—By Reginald Aldworth Daly, Sturgis Hooper Professor of Geology, Harvard University—McGraw-Hill Book Co.—Feb., 1914—Price $4.00—For sale by Book Department Canadian Mining Journal.

This book gives the substance of a course of lectures prepared for students in Harvard University and in the Massachusetts Institute of Technology. It is planned to meet the needs of those who desire either a general explanation of igneous rocks, or the more significant facts about them. Part I. is a summary of these facts, with a number of contributions thereto, a large part of which can be described quantitatively. Part II. treats of these facts in the light of the earth problem as a whole. Part III. treats them in relation to the comprehensive theory outlined in Part II.

The treatment is planetary and radically departs from that followed in any other work on this subject. The idea of a stratified earth and the related idea that basalt is the only primary lava are here for the first time systematically tested by the facts of modern petrology.

The author shows ground for belief in the gigantic development of secondary eruptive rocks and lavas; describes the relation between magmatic movements and the building of mountains; and explains volcanic action as well as the modes of igneous intrusion.

The emphasis throughout is on the field relations and the book has been written principally for the practical geologist. Students of ore deposits will find it of assistance in formulating fundamental principles of their science.

As was to be expected, Dr. Daly has written a very interesting book. He is an enthusiastic student of the subject of which he writes. He has contributed in recent years many valuable papers on the natural history of igneous rocks. Fortunately he had used a classification that is founded upon mineral composition.

RECENT PUBLICATIONS OF THE GEOLOGICAL SURVEY, CANADA.

Memoir 23.—Geology of the Coast and Islands Between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft, 152 pp., 17 pls., 5 figs., 1 diag., 1 map, 1913.

Some of the main geological problems treated in this memoir are: The petrography of the igneous rocks of the Coast range, the methods of igneous intrusion and the regional and contact metamorphism of the stratified rocks. The study of details was limited chiefly to the geological relation of those areas where prospects were located or where mining development had been carried on.

Memoir 26.—Geology and Mineral Deposits of the Tulameen District, B.C., by Charles Camsell, 188 pp., 23 pls., 2 figs., 4 maps, 1913.

This memoir describes a rectangular area of 169 square miles lying in the Similkameen mining division in the southwestern part of British Columbia. This area embraces the villages of Tulameen and Granite Creek, the placer mining district of the Tulameen river and its tributaries, the coal basin on Granite creek and Collins gulch, and the gold, silver and copper localities on Bear and Boulder creeks and at other points. Platinum is an important constituent of the placers, and within this district lies the mass of peridotite carrying chromite, with which diamonds of minute size were found to be associated.

Memoir 30.—The Basins of Nelson and Churchill Rivers, by William McInnes, 146 pp., 19 pls., 1 map, 1913. (The map has not yet been received from the press.)

This memoir gives the results of explorations carried on in a rectangular area of about 220,000 square miles, having Fort Churchill at the northwest corner and Prince Albert at the southwest. The geological boundaries are laid down on the map with accuracy only where they cross, or occur in the vicinity of lakes or rivers; elsewhere owing to the extent of the region covered, they are necessarily only approximate. The region forms part of the extensive Pre-Cambrian peneplain of northern Canada encroached upon to the northeast, south, and west by more recent, flat lying sedimentary rocks. It embraces the section of country traversed by the Hudson Bay Railway.

Memoir 37.—Portion of Atlin District, British Columbia, with special references to Lode Mining, by D. D. Cairnes, 129 pp., 32 pls., 5 figs., 4 diags., 1 map, 1913.

Atlin mining district lies in the northwest corner of British Columbia. The placers of this district having been reported on by J. C. Gwillim for the Geological Survey some years ago, this memoir treats more particularly of the lode deposits. The topographical features, general geology and economic geology are discussed. The deposits of economically important minerals that are described are classified as follows:

I. Ore deposits.
- (a) Gold-tellurium veins.
- (b) Gold-silver quartz veins.
- (c) Cupriferous silver-gold veins.
- (d) Silver-lead veins.
- (e) Copper veins.
- (f) Antimony veins.
- (g) Contact-metamorphic deposits.

II. Coal.

Guide Books.—The Geological Survey has published a series of annotated guides to excursions to many of the leading mining centres and points of geological interest throughout the country. They are well illustrated and are accompanied by numerous maps. The areas described embrace sections of country lying adjacent to nearly all the leading transportation lines. They are of convenient size and should be of interest to the geologist or mining engineer visiting these sections of the country for the first time. Applicants should name the part of the country concerning which information is desired.

PERSONAL AND GENERAL

Mr. D. A. Thomas, the British coal operator, is in Ottawa in connection with the proposed railway for development of the Peace River country, where there are large coal deposits.

Mr. W. P. Alderson, general manager for the Motherlode Sheep Creek Mining Co., has returned to British Columbia from a visit to Eastern Canada.

Mr. Chas. A. Banks, general manager for the Jewel-Denero Gold Mining Co., is back at the Jewel mine, in Boundary district, British Columbia, after an absence of between two and three months, during which he made a trip to England and return. Mr. H. D. Quimby, who was in charge of the Jewel gold mine and stamp mill during Mr. Banks' absence, will probably return to the United States.

Mr. Clarence Cunningham, of Seattle, Washington, formerly interested in coal lands in Alaska, recently visited the Wonderful silver-lead mine, near Sandon, B.C., on which he and associates have been doing development work.

Mr. J. K. Cram has succeeded Mr. Roy Wethered as local superintendent of the Consolidated Mining and Smelting Co.'s several mines in Ainsworth camp, B.C.

Mr. Henry S. Fleming, of New York City, who is acting general manager for the Canadian Collieries (Dunsmuir) Limited, has been on Vancouver island, British Columbia, looking into the company's affairs, he having recently succeeded Mr. W. L. Coulson, general manager, who resigned.

Mr. A. Gordon French, of Nelson, B.C., left that province for England a few weeks ago, probably on a visit.

Mr. Thos. Graham, chief inspector of mines for British Columbia, paid an official visit to the Crowsnest district, Southeast Kootenay, just about the time the Rocky Mountains branch of the Canadian Mining Institute was holding a meeting at Fernie, in that district.

Sir Richard McBride, premier and minister of mines for British Columbia, arranged to pay a visit to Ottawa during the latter part of March.

Mr. Gordon McKenzie, gold commissioner for Yukon, was in Vancouver, B.C., about the middle of March on his return to the North after having spent part of the winter in California.

Mr. J. J. Malone, of Nelson, B.C., has been appointed liquidator of the Kootenay Gold Mines, Ltd., in place of Mr. E. K. Beeston, who died lately. The company was organized a few years ago to operate the Granite-Poorman gold mines and stamp mill in Nelson mining division, but was handicapped by lack of money for development work.

Mr. G. Middleton, manager of the Dominion Assay Office, Vancouver, B.C., is away on a three months' vacation. During his absence Mr. J. B. Farquhar is in charge of the assay office.

OBITUARY.

Mr. Duncan Irvine, who died in Victoria, British Columbia, on March 16, had been resident in that Province for 25 years or more. He was born near Blair Atholl, Perthshire, Scotland, in 1853. After a college course in Edinburgh, he gave particular attention to the study of geology, and was for a number of years in the service of the Royal Scottish Geological Survey. He went to California in 1886, and afterward to British Columbia. For three years 1906-1908, he was manager for the Berry Creek Mining Co., which was engaged in hydraulic gold mining in the vicinity of Dease lake, Cassiar district. Since that time he has been in the employ of the Provincial Government as Public Works Engineer for Vancouver island. He was widely known and generally esteemed, and his death is mourned by very many friends in British Columbia.

YUKON GOLD.

The New York special correspondent of Mining and Scientific Press wrote recently: Yukon Gold shares have been picking up, probably as a result of the good showing made in the report for 1913. With a gross output of $4,789,402, it showed operating profits of $2,537,447. The eight Dawson dredges made profits of $1,827,800, while the hydraulic work at Dawson showed a loss, since most of the season was spent on washing top gravel. The dredge working in the Iditarod made a profit of $507,800 and should do better next year. The two dredges in California brought in profits of $72,000, but one of them has only been at work a short while. Some comparisons of cost will be of interest. The hydraulic work at Dawson cost 9.7c., dredging at Dawson 29.53c., and at Iditarod 64.33c. per cu. yd. This high cost is largely due to the collateral and overhead costs. Thus at Iditarod a series of dams had to be built before and behind the dredge; large boulders gave trouble, as did heavy sand from workings above, and a stratum of clay which was encountered. The grade was steep—6 to 10 per cent.—and water was scarce. All these combined to make the necessary dredging cost nearly fifteen times what it is in the more favorable California areas. It is necessary for the company to write off large amounts as depreciation each year, and it still owes the Guggenheim Exploration Co. $2,100,000.

GRANBY.

Vice-President Edwin Thorne of Granby Consolidated, in statement accompanying check for dividend of $1.50, payable yesterday, says:

Results of operations at Grand Forks and Phoenix for quarter ended Jan. 31, 1914, show profit of $167,861, taking the unsold copper at 14½ cents, New York. At Anyox the new smelter was completed in January and news of its being in operation is daily expected, the delay being due to extraordinarily severe weather conditions.

Good progress is being made at the various properties leased and purchased during the last year; ore shipments to Anyox are expected from some of the properties during this month.—Boston News Bureau.

STEEL CO. OF CANADA.

The Steel Company of Canada has completed the sale of a block of $850,000 first mortgage bonds to a banking house in England. The proceeds of the issue will go to replacing working capital used up in expenditure on new construction work at the company's plants last year. The total outstanding bonds of the company are now brought up to $8,850,000, less the $500,000 held in escrow to redeem a like amount of Montreal Rolling Mills bonds. While the new block of bonds just disposed of was sold entirely to an English house, when a public issue is made it is probable that a portion of the $850,000 will be offered in Canada.

Haileybury, Ont., March 17.—The Elliott claims adjoining the Teck-Hughes on the west, have been sold to Toronto interests, who intend to form a company and proceed with development with as little delay as possible.

SPECIAL CORRESPONDENCE

PORCUPINE, KIRKLAND LAKE AND MUNRO TOWNSHIP.

There are unmistakable indications that most of the prospects of merit in the Porcupine camp will be operated before the summer is far advanced. Owing to the keen demand for good gold prospects from London, New York and Cobalt companies, there is hardly a single property of any prospective value that could not now be turned over. It is a question of terms. The most important deal in the camp has been that whereby the McKinley-Darragh-Savage, of Cobalt, will enter the field as the temporary owners of the Jupiter mine.

Porcupine Crown Mine Buildings and Cyanide Plant, Timmins, Ont.

They will hold it on a six months' working option, with no money down, but a contract to do a large amount of development work that should place the Jupiter definitely among the list of regular producers —if the mine is ever to take that rank. The purchasing company will also pay off the bonds which some of the principal shareholders in Montreal now hold against the company.

The Jupiter has been closed down for almost a year. It is well understood that the abandonment of operations was due not at all to the merits of the mine, but to the condition of the money market at the time and the necessity the syndicate then controlling the property found to protect their interests elsewhere. There is not at the present time a plant on the Jupiter large enough to carry on extensive operations, the plant of the adjoining property, the Plenaurum, being utilized at the time when operations ceased. Plans were drawn for a mill in anticipation of the erection of a plant; but the purpose of the McKinley-Darragh will, no doubt, be to put as large a tonnage of ore in sight as possible during their option. The agreement arrived at between the McKinley and the majority stockholders and bondholders of the Jupiter will probably be confirmed at a meeting of shareholders in Montreal on April 3rd. The Jupiter was mentioned as one of the properties likely to be included in a merger of Pearl Lake properties some time ago.

Foley-O'Brien.—Good ore has been struck in a winze at the Foley-O'Brien, which is now controlled by the Homestake Finance Co. of Buffalo. It was discovered as the result of an extensive scheme of development. A winze was sunk from the 160 ft. level to the 250 ft. level. At this point some excellent indications were found, which led the management to crosscut. Some remarkable ore is now being taken out of the vein. Drifting on the vein on both directions is now being pursued. The ore shoot was found directly under the creek, which runs just west of the town of South Porcupine. The Homestake Mines Finance Co. purchased the control of the Foley-O'Brien. In addition to work near the town, the No. 3 shaft, near the T. &. N. O. tracks, is being sunk to the 250 ft. level.

The Alexo mine, at Porquis Junction, shipped 622 tons of nickel ore last month, the heaviest from the mine in several months. The ore was consigned as usual to the Mond Nickel Co. at Coniston. Nineteen cars were loaded and shipped, more than one, each two days. This ore has been taken out of an open cut at 80 ft. and a drift of 115 ft. taken from the bottom of the open cut. The ore shipped—disseminated and massive—will average 5 per cent. in nickel. The ore, which has a width of about 20 ft. in the drift, is good in the bottom of the working. The plant with which the ore has been removed consists of only one drill run by a small boiler. The ore is hoisted with a small hoist. The working force consists of nine men.

Dome Mine.—The statement for Dome mine for February shows a tonnage of 12,000 milled, $69,-000 recovered, and a value per ton of $5.74. The low tonnage milled is due partly to the fact that power was off for four or five days in a short month. The value per ton is the lowest yet shown in the Dome statements. The average value of recovery a ton for 11 months is $8.57. In April and May of last year the value was at a maximum, being over $13 a ton. During January this year the value was just over $8 a ton, and the recovery was $111,500. During that month the mill treated $13,900 tons, one of the best periods shown. The annual meeting of the Dome will be held this month.

North Dome.—The directors elected at the annual meeting of the North Dome Mining Co. were: Messrs. Richard Cartwright, president; Chas. L. Sherrill, vice-president; Alec Fasken, secretary-treasurer; Arthur Whitbeck and W. Thayer, directors. The property is controlled by the Timiskaming Mining Co.

COBALT, GOWGANDA AND ELK LAKE

Several cuts in the dividends of Cobalt companies announced during the week has caused much outside comment. In as much as it has been common knowledge in the camp that the margin of profit over net earnings has been very narrow for some time on the Nipissing, the cut from 30 per cent. a year to 20 per cent. has been for some time foreshadowed. The directors felt that the burden of paying $450,000 a quarter was more than the profits on the lower grade of ore now being mined would bear for any length of time. At the same time the big surplus announced shows that the Cobalt Co. could have maintained the extra disbursement for some time had they so chosen.

A Cobalt Merger.—Announcement of the big merger of Cobalt companies controlled in England has been quickly followed by the detailing of plans for centralizing operations, with the Cobalt Townsite as a base. A new main working shaft has been started by the Cobalt Townsite Mining Co. and the steel head frame will be constructed over the working. A raise has been started from the 400 ft. level of the mine and it will break through about 60 ft. north of the mill of the Cobalt Reduction Co. The shaft will have two compartments for hoisting and will serve five levels. The steel head frame, the second in the camp, will be started next month and will be completed early in May. Hoisting from the new main shaft will commence about the first of June. This shaft will also afford a means whereby the City of Cobalt ore can be taken to the mill more expeditiously. It is now being hoisted up the main City of Cobalt shaft and run across a raised tramway to the mill. The City of Cobalt has again appeared on the lists as a regular shipper. Concentrates from this property amounting to over 100 tons have left the camp already this year.

A view across Cart Lake, showing Seneca-Superior Mine, Cobalt, Ont.

Nipissing.—During the last month the Nipissing mine mined ore of an estimated net value of $255,159 and shipped bullion customs and otherwise of an estimated net value of $403,366.

At shaft No. 64, a depth of 900 ft. has been attained at which point a station has been established and a start made on a crosscut for the vein 255 ft. away. The formation at this depth is rhyolite, but it is expected that the vein will be found to occur in other Keewatin rocks. In order to find the depth of the diabase capping and the thickness of the underlying conglomerate, a vertical hole in now being put down with a diamond drill near Peterson Lake. At the beginning of the month the hole was 244 ft. deep and still in the diabase, although it is expected that the conglomerate may be encountered at any time now. Preparations are now being made for the washing of the surface on the Nipissing property tributary to Peterson Lake. The foundations and piers for the suction of the hydraulic pump are now being put in on the west shore of Peterson Lake, near the southeast corner of R. L. 404.

Right of Way.—Owing to the discovery of another high grade vein on the Right of Way Mining Co.'s shaft at the south end of the lake active operations have been resumed at both shafts. A vein was cut some weeks ago, and it is now beginning to make good ore at the 120 ft. level. There is at the present time in the face a vein two to two and a half in. wide, of 3,000 oz. ore. It has already been drifted upon for 50 ft. For more than a year now operations at the Right of Way have been confined to the milling of dump ore at the Colonial mill.

Maidens Property.—At one of the few properties now working in South Lorrain an encouraging development is announced. In a contact vein of the diabase vein and Keewatin, on the Maidens property, some ore of good milling possibilities has been encountered. The new vein shows between eight and ten in. of calcite carrying native silver, while 15 in. of wall rock beside the vein will make profitable milling ore. The vein was found at the 75 ft. level of the No. 2 shaft.

The Caribou Cobalt is to-day paying dividends from profits made on ore which would not even have been milled two years ago. Owing to the fact that the Dominion Reduction Co. is already crowded with ore, the management cannot raise its tonnage milled to more than 1,175 tons per month, instead of the 1,800 tons aimed at. The net profit per month under the tonnage shipped is running between $10,000 and $12,000. Developments in the mine have been favorable. The ore reserves in the mine to-day have been considerably increased by the discovery that the wall rock will pay to mine for some distance farther back from the original drifts than was at first imagined.

More is now in sight than when the mine was taken over from the Drummonds. Stopes are developed from 5 to 13 ft. wide on the various veins in the mine. In one place a chamber, 70 ft. by 70 ft., is being worked. There is some high grade vein matter, low grade vein matter, and a good deal of leaf and ruby silver. The general average of the milling feed is about 33 oz. to the ton.

Seneca-Superior.—The second annual report of the Seneca Superior Mining Co. shows that total production was 1,085,774 oz. and the reserves underground were 3,460,000 oz., an increase of 2,310,000 oz. over last year. The profit from mining operation was $306,854 and the net profit was $286,626. The total dividends paid during the year were $263,126, and the surplus shows $85,290. The cash in bank amounted to $65,492.

Timiskaming.—The fight for control of the Timiskaming mine resulted in the victory of the Wills-Culver party and the appointment of a board of directors favorable to their interests. Mr. Norman Fisher, for many years manager of the Timiskaming mine for the Cartwright control, has announced his resignation. Mr. F. L. Culver, president and general manager of the Beaver, spent several days at the property making a thorough examination, both underground and on the surface.

Miller Lake-O'Brien.—The main shaft of the Miller Lake-O'Brien mine in Gowganda has just reached the 459 ft. level, and drifting on one of the series of veins has commenced. At this depth there appears to be no change in grade or width of veins. At the new Millerett shaft at the 60 ft. level one vein has already been cut. At 300 ft. on the Miller Lake-O'Brien there is a continuous shoot of high grade ore for 500 ft., but it is not more than an inch in width. On the 350 ft. level this same vein is also strong. It is expected that hydro-electrical power will be available in about two months' time, when the management will have 18 drills available for underground work. A new 15 drill compressor is in readiness when the juice is turned on.

Bailey.—According to the report issued by the Bailey Cobalt Mines, Ltd., it is certain that development on that property will be continued. Mr. E. A. Benson and his Chicago associates, who have been providing the money for development for the past two or three years, are satisfied enough with the progress of the company to continue to stand behind the property. The financial statement shows that at the end of the year there was $4,738 cash in bank and $33,545 in accounts receivable. Mr. Weed, the mine manager, declares that the property would receive a fair chance if $37,700 were spent on it during the next 15 months. It would then be possible to maintain development and put ore in sight. On the fifth level in the conglomerate the vein is looking extremely well.

McKinley-Darragh.—The report of the McKinley-Darragh, which has just been made public, shows that ore reserves, which were 5,358,500 at the end of 1912, have now fallen to 3,210,000 oz., a decrease of 2,158,-500 oz. in the year. This report is undoubtedly disappointing, but was foreshadowed in the last annual report and in the ever decreasing production as detailed in the monthly statement.

The directors state that new ore developed amounted to but 512,739 oz., showing that a large portion of the dividends were taken from ore reserves. The cost per oz. of mining silver increased from 18 cents to 22 cents. The total silver recovered during the year was 2,214,536 oz., compared with 2,717,383 oz. in 1912.

BRITISH COLUMBIA

COAST DISTRICT NEWS.

A rancher and prospector, who has been in the Peace River country for the last 15 years, when visiting Victoria lately, stated that already valuable mineral discoveries have been made in that region, including placer gold, quartz containing copper and gold, galena and coal. However, owing to the comparative inaccessibility of the country, but little prospecting has yet been done.

The steamer British Columbia was at Tassoo harbor about the middle of March taking on ore from the property of the Tassoo Syndicate, Ltd., situated on the west coast of Moresby island, of the Queen Charlotte group. The intention was to ship about 750 tons to the smelter at Tacoma, Puget sound, Washington. Mr. Robert R. Hedley, of Vancouver, president of the syndicate, went in the steamer to supervise shipment of the ore.

With winter breaking up early, there has been quite an exodus of prospectors and miners from Hazelton to the Omineca country, the men taking the trail when the snow commences to go, so as to cross the summits while the travelling is good and to get over the streams before spring freshets make fording risky. Beside numbers of individual miners, the Royal Standard Investment Co.'s party, and that of the Omineca Gold Mines, Ltd., are going in early. It is predicted that more gold will be recovered from Omineca river and tributaries in the ensuing season than in any year since the early days.

Granby Co.'s New Smeltery.

A commencement was made on March 16 to smelt ore at the Granby Consolidated Co.'s new smelting works at Anyox, Observatory inlet. The delay in blowing in had been occasioned by insufficiency of power for all necessary uses. The head of water above the intake pipe at the dam had been inadequate until early in March, when a beginning was made to generate power for the smelter where Nordberg and other blowing engines, compressors, sampling-mill plant, electric locomotives and other power machinery have since been given trial runs. Besides that required for the smelting works, power has to be generated for mine work and ore crushing; in addition, electric light for works and the town of Anyox has to be supplied.

Power is obtained from nine big Pelton wheels. Two direct connected compressors are operated; one supplies power for machine drills, etc., in the mine, and the other for the blowers (one for each of the three blast furnaces), blowing engine for converter plant, and other purposes.

A late estimate of available ore in the company's Hidden Creek mines places the quantity at approximately 9,000,000 tons, and the copper content at 2.2 per cent.

Rambler-Cariboo, Slocan.

Announcement has been made that a financial statement to March 1, 1914, has been issued to shareholders in the Rambler-Cariboo Mines, Ltd., operating the Rambler-Cariboo silver-lead mine in McGuigan basin, Slocan district, and a concentrating mill situated about

Mt. Cheops Mt. Sifton, Swiss Peaks and Mount Hermit.
On main line Canadian Pacific Railway, B.C.

two miles below the mine, on Seaton creek. Current accounts to date of statement had been paid and the company's outstanding indebtedness reduced from $67,000 to $29,000. Accompanying the statement to recent date was a report of operations during the last fiscal period ended April 1, 1913. The following is an excerpt: "Since the annual report of 1912 we have completed the new concentrator at an additional cost of $35,808, and an aerial tram from mine to concentrating mill at a cost of $18,073; both tramway and mill have been operating satisfactorily. We have also built a general office, an assay office (which has been equipped), and new boarding and bunkhouses at the mill, and several new buildings at the mine. More ground has been purchased for $11,000, and we have on hand store supplies and explosives valued at $2,200. There is now due to the company about $12,000 from ore shipments, which will be ample to finance the work when there shall be a sufficient water supply to allow of operations being resumed.

A supplementary report by the company's manager gives the following information: "Because of water shortage operations could not be carried on properly, so ore production was stopped and the mill closed until there should be ample power for again working under favorable conditions. Development work is being continued in the mine, in which there is in sight sufficient ore to supply the mill, operating at capacity, for at least 24 months; meanwhile we should expose other ore bodies as a result of the development work in progress. There are in the mine several places from which we can take out considerable clean shipping ore, so I have good reason to believe that my estimate of increased net earnings for the current year will be verified.

Vancouver Island Collieries Again Exporting Coal.

About 1,340 tons of coal was shipped on March 11 from Nanaimo and South Wellington mines to Seattle, Washington, this indicating a resumption of the coal export trade from Vancouver Island collieries after an interruption of ten months, from the time of the coal miners' strike on May 1, 1913. Meanwhile, approximately 77,000 tons of Washington coal has been shipped from Seattle to several British Columbia coast cities, much of it at a price as low as $3.50 a ton, with a prospect of a fair proportion of this trade being retained notwithstanding that Vancouver Island coal mines are all again producing.

Both the Western Fuel Co. and the Vancouver-Nanaimo Coal Mining Co. were busy in March bunkering steamers, chiefly small ones, and loading scows with coal for shipment to the larger cities of the near coast. The Western Fuel Co, now has about 700 non-members of the United Mine Workers of America employed in its mines near Nanaimo, and the Pacific Coast Coal Mines, Ltd., about 150 men—also not members of the U.M.W. of A.—at its South Wellington colliery. The Vancouver-Nanaimo Coal Mining Co. is working U. M. W. of A. men at its Jingle Pot mine, three miles from Nanaimo.

The Western Fuel Co. and an Agreement Committee appointed by its employees have signed an agreement, which provides for, among other things, a general increase of ten per cent. on wages rates that were paid prior to the strike, the agreement to continue in force until the end of September, 1916. This advance is similar to that offered by the company last August. Apart from the rates of pay, provision is made for a mine committee to meet the management of the company to adjust all matters of dispute that shall from time to time come up. While this agreemnt only deals with underground employees, the surface men have not been overlooked, for their wages scale is being revised and will shortly be completed. The new schedule to cover their rates of pay will be effective as from the same date—March 6, 1914—as that of the underground employees.

A supplementary agreement has also been signed. It provides:

"(a) It is agreed that in the event of a fatal accident occurring in the mines, or in the event of a death resulting from injuries received in the mine that the operation of the mine in which the accident occurred shall not be suspended on the day of the funeral of the deceased party, but that any employee wishing to absent himself from work for the purpose of attending the funeral shall have the privilege of doing so. All employees working on the morning, afternoon and night shifts of the funeral agree to contribute the sum of one dollar ($1) per man and fifty cents (50c.) per boy to a fund to be given to the nearest relative of the deceased party. The company agrees to duplicate the sum contributed by the employees. For the purpose of this section all employees whose daily wage is less than three dollars ($3) per shift shall be considered as boys. The company is authorized to make collections for this fund from the payroll of its employes in manner similar to other collections. Nothing in this section shall relieve the company of any obligation under the Workmen's Compensation Act, nor

Eagle Peak Mt. Sir Donald and Illecillewaet Glacier.
On main line Canadian Pacific Railway, B.C.

shall it relieve the employes of their obligation to the Medical Relief and Accident Fund.

"(b) It is agreed that monthly meetings of the management of the company and the Agreement Committee shall be held on the afternoon of the first Wednesday of each month at the company's general office. Special meetings may be called at any time by the management of the chairman of the Agreement Committee, due notice of such meeting to be given to all parties."

As evidencing that the Canadian Collieries (Dunsmuir) Limited has restored industrial conditions to normal state so far as its Comox colliery, with mines in the neighborhood of Cumberland, Vancouver Island, is concerned, the statement has been published that the Canadian-Australian steamer Marmara commenced taking on bunker coal at Union bay at midnight of March 7, and by 9 o'clock the morning of March 9 had shipped 2,200 tons.

COBALT SHIPMENTS.

(Cobalt Nugget.)

The Right of Way figured in a very light list of ore shipments this week, although almost a quarter of a million ounces of refined silver from the Nipissing high grade camp will bring up the average for the camp. The shipment was of concentrates from the Colonial mill, where the dump ore of the Right of Way is being treated. The Right of Way is now working both shafts again. The extension of one of the producers of the Princess has rewarded their exertions to the south.

The Penn-Canadian car contained about 900 ounce to the ton concentrates and ore mixed. Developments within the past two or three months at the Penn-Canadian Company point to much more regular shipments from this property. The McKinley-Darragh contributed two cars of concentrates and thereby raised the total for the week very considerably. All the ore came from the mines surrounding the town, Kerr Lake and South Coleman, the Casey range not contributing.

The ore shipments from the mines for the week ending March 20, were:

	High.	Low.	Tl.Lb.
Right of Way	83,120	.....	83,120
McKinley-Darragh	149,760	.....	149,760
Cobalt Lake	63,970	.....	63,970
Penn-Canadian	64,630	.....	64,630
Dom. Reduction	.....	88,000	88,000

The bullion shipments for the week ending March 20th were:

Mine.	Bars.	Ounces.	Value.
Nipissing	199	238,316.33	$138,223.47
Timiskaming	2	1,951.00	1,003.00
Bailey	2	1,462.00	763.25
Penn-Canadian	2	1,291.00	673.38
Hargraves	1	794.00	414.81

MINERAL PRODUCTION OF ONTARIO, 1913.

Metallic.

Product.	Quantity.	Value.
Gold, oz.	220,837	$4,558,518
Silver, oz.	29,724,931	16,580,114
Copper, tons	12,941	1,840,492
Nickel, tons	24,838	5,237,477
Iron ore, tons	195,937	424,072
Pig iron, tons	648,899	8,719,892
Cobalt oxide, etc., lb.	1,188,526	420,386
Nickel oxide, lb.	232,255	13,326
	.....	$37,794,277
Less Ontario iron ore (132,708 tons) smelted into pig iron	.....	285,322
Net value metallic production	.....	$37,508,955

Non-Metallic.

Arsenic (refined), lbs.	2,450,758	$64,146
Brick (common), number	386,882,000	3,283,894
Brick (paving, fancy, etc.), number	18,547,000	243,119
Brick (pressed), number	76,138,000	871,291
Building and crushed stone	....	1,117,153
Calcium carbide, tons	2,052	123,100
Cement, Portland, bbl.	3,802,321	4,105,455
Corundum, tons	1,177	137,036
Feldspar, tons	18,615	73,338
Graphite (refined), tons	1,788	93,054
Gypsum, tons	40,581	92,627
Iron pyrites, tons	71,620	171,687
Lime, bush.	2,300,991	390,600
Mica, tons	386	55,264
Natural gas, million cu. ft.	12,559	2,428,881
Peat, tons	500	1,750
Petroleum, Imp. gal.	7,915,761	398,051
Pottery	.....	52,875
Quartz, tons	54,320	130,860
Salt, tons	96,799	474,372
Sewer pipe	.....	600,297
Sand and gravel, cu. yd.	413,978	229,967
Talc (ground), tons	17,988	100,480
Tile, drain, number	14,265,000	251,705
Non-metallic production	.....	$15,491,002
Add metallic production	.....	37,508,955
Total production	.....	$52,999,957

Note—One ton equals 2,000 lb.

Byers' genuine wrought iron pipe was specified throughout in the plans for the L. C. Smith building, Seattle, the tallest building outside of New York. Byers' pipe is made from all straight pig iron muck bar without the use of scrap of any description—no admixture of any foreign material whatsoever. The non-corrosive quality of wrought iron is due chiefly to the puddling process. Realizing this, the Byers people have never varied from their old-time method of thorough hand puddling by expert puddlers.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Building, Toronto, Ontario.)

March 23, 1914.

New York Curb.

	Bid.	Ask.
British Copper	1.37	1.50
Braden Copper	8.12	8.25
California Oil	352.00	354.00
Chino Copper	42.12	42.37
Giroux Copper	1.00	1.25
Green Can.	38.00	40.00
Miami Copper	24.00	24.25
Nevada Copper	15.87	16.00
Ohio Oil	241.00	242.00
Ray Cons. Copper	21.62	22.00
Standard Oil of New York	240.00	250.00
Standard Oil of New Jersey	420.00	422.00
Standard Oil (old)	1,500.00	....
Standard Oil (subs)	1,080.00	....
Tonopah Mining	7.00	7.12
Tonopah Belmont	7.06	7.75
Tonopah Merger	.55	.58
Inspiration Copper	17.25	17.50
Goldfield Cons	2.87	3.12
Yukon Gold	2.87	3.12

Porcupine Stocks.

Apex	.03¼	.03½
Dome Extension	.11½	.12
Dome Lake	.47	.48
Dome Mines	12.90	13.25
Foley O'Brien	.25	.35
Hollinger	15.90	16.00
Jupiter	.11½	.11¾
McIntyre	2.00	2.15
Moneta	.02	.04
North Dome	.15	.20
Northern Exploration	2.25	2.75
Pearl Lake	.08	.08½
Plenaurum	.40	.60
Porcupine Gold	.12	.12¼
Imperial	.02	.02½
Porcupine Reserve	....	.10
Preston East Dome	.02	.02½
Rea	.15	.20
Swastika	.04	.04½
United	....	.01
West Dome	.10	.12
Porcupine Crown	1.20	1.25
Teck-Hughes	.20	.25

Cobalt Stocks.

Bailey	.04	.04½
Beaver	.31	.32
Buffalo	1.25	1.40
Canadian	....	.10
Chambers Ferland	.19½	.20
City of Cobalt	.51	.60
Cobalt Lake	.63	.68
Coniagas	7.90	8.10
Crown Reserve	1.85	1.87
Foster	.07	.09
Gifford	.03½	.04
Gould	.03	.03¼
Great Northern	.15¾	.16
Hargraves	.02½	.03
Hudson Bay	70.00	75.00
Kerr Lake	4.50	4.60
La Rose	1.63	1.66
McKinley	.74	.78
Nipissing	6.05	6.10
Peterson Lake	.43	.43¼
Right of Way	.04	.06
Rochester	.02½	.03
Leaf	.02	.02½
Cochrane	.40	.50
Silver Queen	.04	.05
Timiskaming	.15	.15½
Trethewey	.23	.27
Wettlaufer	.06	.07
Seneca Superior	3.00	3.25

TORONTO MARKETS.

March 25.—(Quotations from Canada Metal Co., Toronto).
- Spelter, 5¼c. per lb.
- Lead, 5¼c. per lb.
- Tin, 41½c. per lb.
- Antimony, 9c. per lb.
- Copper, casting, 15½c. per lb.
- Electrolytic, 15¼c. per lb.
- Ingot brass, 10 to 15c. per lb.

March 25.—Pig Iron—(Quotations from Drummond, McCall & Co., Toronto):
- Summerlee No. 1, $26.50 (f.o.b. Toronto).
- Summerlee No. 2, $25.50 (f.o.b. Toronto).

March 25.—Coal (Quotations from Elias Rogers Co., Toronto):
- Anthracite, $8.25 per ton.
- Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

March 23.—Connellsville coke (f.o.b. ovens).
- Furnace coke, prompt, $1.90 to $1.95 per ton.
- Foundry coke, prompt, $2.40 to $2.60 per ton.

March 23.—Tin, straits, 38.60c.
- Copper, Prime Lake, 14.75c.
- Electrolytic copper, 14.35 to 14.45c.
- Copper wire, 15.50 to 15.75c.
- Lead, 4c.
- Spelter, 5.27½ to 5.32½c.
- Sheet zinc (f.o.b. smelter), 7c.
- Antimony, Cookson's, 7.20 to 7.25c.
- Aluminum, 18 to 18.25c.
- Nickel, 40 to 45c.
- Platinum, hard, 10 per cent., $46 to $47.50 per oz.
- Platinum, hard, 20 per cent. $49 to $51.50 per oz.
- Platinum, soft, $43 to $44 per oz.
- Bismuth, $1.95 to $2.15 per lb.
- Quicksilver, $38 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
March 11	58⅛	26 13/16
" 12	57⅞	26 11/16
" 13	58	26¾
" 14	58⅛	26 13/16
" 16	58⅛	26 13/16
" 17.	58⅛	26 13/16
" 18	58	26¾
" 19	58	26¾
" 20	58	26¾
" 21	58⅛	26 13/16
" 23	58⅛	26 13/16
" 24	58⅛	26 13/16

They All Like The

JACKHAMER

From the Blacksmith to the Superintendent.

It Is The Rock Drill Used without a mounting

The Jackhamer is an all-steel, self-rotated, self-lubricated drill operated by steam or air.

The Jackhamer uses the Non-Freezing Butterfly valve, a convenient steel holder and an effective hole cleanin device.

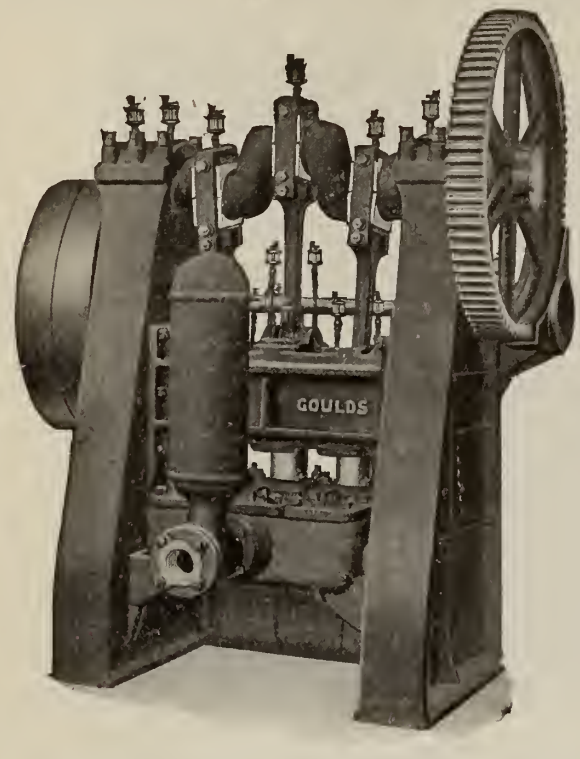
Catalog K-68

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works : SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam Shovels**: Specially Flexible Ropes for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:—

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & D
Heys, Thos. &

Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd

Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place - New York City
General Manager
Consolidated Arizona Smelting Co.,
Humboldt, Ariz.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

What is your specialty ?
What is your address ?
Our readers want to know.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

LAWYERS

Telephone Main 3813 — Cable Address: "Chadwick" Toronto, Western Union Code
E. M. Chadwick, K.C. — Beatty, Blackstock, Fasken
David Fasken, K.C. — Cowan & Chadwick
M. K. Cowan, K.C. — Barristers, Solicitors, Notaries
Harper Armstrng — Offices: Bank of Toronto, Cor. Wellington & Church Sts.
Alexander Fasken — 58 Wellington St. East, Toronto
Hugh E. Rose, K.C.
Geo. H. Sedgewick.
James Aitchison

G. G. S. Lindsey, K.C.
with
Gregory & Gooderham,
Barristers and Solicitors,
Canada Life Building,
Toronto

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

Smith & Travers Diamond Drill
Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

WANTED. Chemist and Assayer with cyaniding experience, capable of looking after cyanide plant. Apply Box "E," Canadian Mining Journal, Toronto, Can.

WANTED. First-class Master Mechanic for large gold mine. Apply Box "F," Canadian Mining Journal, Toronto, Can.

TO INVESTORS
I want $1,500 to fit out a prospecting expedition to carry on exploration work in the new gold field. Parties putting up the money will be entitled to a claim.
Box "A". Canadian Mining Journal

The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....

Address .....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

Guide Books to excursions of the International Geological Congress.

1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1173. Memoir 20. Gold fields of Nova Scotia, by W. Malcolm. Map not published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1279. Memoir 25. Report on the clay and shale deposits of the Western Provinces, by Heinrich Ries and Joseph Keele.

1225. Memoir 30. The basins of Nelson and Churchill rivers, by William McInnes. Map not published.

BRITISH COLUMBIA

1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1162. Map 26A. Bathurst and vicinity, Gloucester County, New Brunswick. Topography.

1163. Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.

1300. Map 100A. Bell River, Quebec. Geology.

1301. Map 101A. St. Hilaire and Rougemont Mountains, Rouville and St. Hyacinthe Counties, Quebec. Geology.

ONTARIO

1199. Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.

1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.

1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.

1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.

1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.

1304. Map 106A. Groundhog coal field, British Columbia. Geology.

1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

1298. Map 99A. Southern portion of Cranbrook map-area, East and West Kootenay, British Columbia. Geology.

YUKON and NORTH WEST TERRITORIES

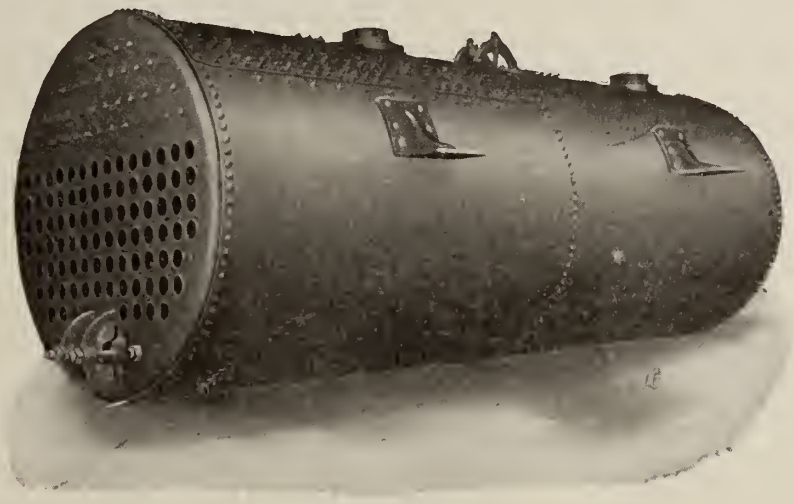
1332. Map 113A. Canadian routes to White River district, Yukon, and to Chisana district, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BOILERS



"INGLIS" STANDARD RETURN TUBULAR BOILER

We make Boilers of all kinds for any service.

For Fifty-two (52) years our boilers have been recognized as the Canadian Standard because they combine all the essentials requisite to produce the best boiler.

Is is a pleasure for us to show prospective buyers our different types of boilers in operation.

WRITE US FOR PRICES AND SPECIFICATIONS

The John Inglis Co.,
LIMITED

Engineers and Boilermakers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office: 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

¶ *Complete Bound Copies for 1913 Canadian Mining Journal, with Index, are now ready. Price $4.00 per volume. Canadian Mining Journal, 44-46 Lombard Street, Toronto.*

All Ready!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co. 22
Amatite Roofing 13
American Diamond Rock Drill Co. 16
Astley, J. W. 23

B

Bartlett, C. O., & Snow Co. 17
Bath, Henry & Son 28
Beatty, Blackstock, Fasken, Cowan & Chadwick 24
Beatty, M. & Sons, Ltd. 11
Belleville Assay Office 25
Bennett, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons 16
Blackwell, Geo. G., Sons & Co. ... 28
British Columbia, Province of ... 18
Brown & Butters 23
Burchell, Geo. B. 23

C

Canadian Allis-Chalmers, Ltd. ....Inside front cover
Campbell & Deyell 25
Canadian Bag Co. 13
Canadian Bank of Commerce 8
Canadian Cleveland Drill Co 9
Canadian Copper Co. 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Laboratories, Ltd. 25
Canadian Northern Steamships ... 6
Canadian Ingersoll-Rand Co., Ltd. .....3 and 21
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith 23
Cohen, S. W. 23
Colvocoresses, G. M. 23
Consolidated Mining & Smelting Co 28
Coniagas Reduction Co., Ltd. 28
Curtis's & Harvey ....Outside back cover

D

Dept. of Mines, Canada 26
Deloro Mining & Reduction Co... 28
DePencier, H. P. 23
Diamond Drill Contracting Co..... 16
Dominion Coal Co., Ltd. 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co. 16
Donald, Dr. J. T. 25
Drury, H. A. Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W. 23

F

Ferrier, W. F. 23
Fleck, Alex. 6
Flory, S., Mfg. Co. 12
Forbes, D. L. H. 23
Fowler, S. S. 23
Fraser & Chalmers of Can., Ltd.... 4
Federal Engineering Co., Ltd. 31

G

Graham, S. N. 23
Gray, John 25
Greening, B., Wire Co., Ltd. 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John 24
Hardman, J. E. 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd. 25
Heys, Thos. & Son 25
Hille, F. 24
Holman Drill Co. 20

I

Inglis, John & Co., Ltd. 27
Imperial Bank of Canada 2
Industrial & Technical Press 29
International Nickel Co. 8
International Engineering Works Ltd. 11

J

James Ore Concentrator Co. ....Outside back cover
Jeffrey Mfg. Co. 19
Johnson, W. S. 24
Jones & Glassco 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co. 25
Legg Brothers Engraving Co. 35
Loring, F. C. 24
Lymans, Limited 9
Lands of the Algoma Central and Hudson Bay Ry. 3
Lindsey, G. G. S. 24

M

Morton, B. K. & Co. 18
McEvoy, James 24
Mussens, Limited ....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co. 10
Nova Scotia, Province of 15
Northern Canada Supply Co., Ltd. 6
Northern Electric Co., Ltd..... 5

O

Orenstein-Arthur Koppel Co 5
Orford Copper Co. 8
Ontario, Province of 30

P

Paterson Mfg. Co. 13
Peacock Bros. 7
Pickings, H. B. 24
Pyke, James W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd. 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Segsworth, W. E. 24
Smart-Turner Machine Co. 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd. ....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Standard Underground Cable Co... 15
Sullivan Machinery Co. 2
Summerhayes, Maurice W. 24
Swedish Steel & Importing Co., Ltd. 12

T

Jeo. Taylor Hardware Co., Ltd. ... 4
Toronto University 2
Tyrrell, J. B. 24

W

Willmott, A. B. 24
Walker Bros. 7
Waterous Engine Works Co., Ltd... 9

Lanco Balata Belting

can be used under almost any conditions except those of heat. ¶ It is as nearly stretchless as it is possible to make a belt. ¶ This is the belt that is noted for its long life. ¶ Write for useful belting book—"The Main Drive."

Federal Engineering Co., Ltd.

Toronto Montreal

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

THE ROESSLER & HASSLACHER CHEMICAL COMPANY CHEMISTS NEW YORK 106 Cedar

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.
Geo. Taylor Hardware Co,Ltd

Bags—
Canadian Bag Co., Ltd.
Smart-Woods, Ltd.

Ball Mills—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineering Co., Ltd.
G. Taylor Hardware Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd
Curtis & Harvey (Canada), Limited.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Blowers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Boilers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
The John Inglis Co., Ltd.

Buckets—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd

Cable — Aerial and Underground—
G. Taylor Hardware Co., Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Cables—Wire—
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.
G. Taylor Hardware Co., Ltd.

Carriers—
The Herbert Morris Crane & Hoist Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co.

Case Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Cement Machinery—
Canadian Allis-Chalmers, Ltd
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Chain Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell
Thos. Heys & Son
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Handling Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Compressors—Air—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd
Laurie & Lamb
Canadian Westinghouse
Can. Ingersoll-Rand Co. Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Condensers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Bros.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse
Fraser & Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Waterous Engine Works
Canadian Fairbanks-Morse Co., Ltd.

Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Gantry—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Hand Power—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith
B. Greening Wire Co., Ltd.
G. Taylor Hardware Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Lymans, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roessler & Hasslacher
Mussens, Ltd.
Thos. & Wm. Smith
Peacock Bros.

Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Canadian Allis-Chalmers, Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Can. Ingersoll-Rand Co., Ltd

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Ltd.
Orenstein-Arthur Koppel Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Canadian Allis-Chalmers, Ltd

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Elevators—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Peacock Bros.

Engineering Instruments—
C. L. Berger & Sons
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Mussens, Ltd.
Alex. Fleck
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
M. Beatty & Sons
Canadian Westinghouse
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.
Can. Fairbanks-Morse Co.

Engines—Oil—
Peacock Bros.
Can. Fairbanks-Morse Co.

Engines—Steam—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.
Robb Engineering Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons
Laurie & Lamb
Mussens, Ltd.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Filters—
Krupp, Fried, A. G., Germany

Friction Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.

Forgings—
M. Beatty & Sons
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Bros.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :					Halifax
QUEBEC :					Montreal
ONTARIO :	Toronto,	Cobalt,	South Porcupine,	Port Arthur,	Kingston
MANITOBA :					Winnipeg
ALBERTA :					Edmonton
BRITISH COLUMBIA :	Vancouver,	Victoria,	Nelson,		Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krup, Fried. A. G., Germany
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey, (Canada), Limited
Canadian Westinghouse
Canadian Explosives
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Gears—
Canadian Westinghouse
Krupp, Fried. A G., Germany
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Girders—Steel—
Dominion Bridge Co.

Gravity Lowering Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Hangers—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Heaters—Feed Water—
Mussens, Ltd.
Laurie & Lamb
Canadian Westinghouse
Peacock Bros.
Fraser & Chalmers, Ltd.
G. Taylor Hardware Co., Ltd.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
S. Flory Mfg. Co.
Jones & Glassco
Waterous Engine Works
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Ltd.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Can. Cleveland Drill Co.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Jacks—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives
Peacock Bros.
Ackroyd & Best
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works
Northern Canada Supply Co.
Jones & Glassco

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.
Canadian Westinghouse
Siemens Co. of Canada, Ltd.

Locomotives—Steam—
Mussens, Ltd.
Canadian Westinghouse

Metal Merchants—
Henry Bath & Son
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
G. Taylor Hardware Co., Ltd.
Canadian Westinghouse
Peacock Bros.
Siemens Co. of Canada, Ltd.

Ore Sacks—
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Ore Testing Works—
Ledoux & Co.
Can. Laboratories
Milton Hersey Co., Ltd.
Campbell & Deyell

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada
Krupp, Fried, A. G., Germany
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Thos. & Wm. Smith
Peacock Bros.

Pipes—
Consolidated M. & S. Co.
Peacock Bros.
G. Taylor Hardware Co., Ltd.
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Canadian Westinghouse
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
G. Taylor Hardware Co., Ltd.
Jones & Glassco

Producer—Gas—
Krupp, Fried, A. G., Germany
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
G. Taylor Hardware Co., Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Laurie & Lamb
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
G. Taylor Hardware Co., Ltd.
Can. Fairbanks-Morse Co.
Alex. Fleck
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Jeffrey Mfg. Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumatic—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Can. Ingersoll Rand Co., Ltd.

Pumps—Steam—
Can. Ingersoll-Rand Co. Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
G. Taylor Hardware Co., Ltd.
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A. G., Germany
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany

Rolls—Crushing—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Can. Allis-Chalmers, Ltd.

Roofing—
Paterson Mfg. Co.
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.
Geo. Taylor Hardware Co,Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.
G. Taylor Hardware Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany
Thos. Heys & Son

Screens—
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
R. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Self Landing, Self Delivery Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Mussens, Ltd.
M. Beatty & Sons

Slime Tables—
Deister Concentrator Co.
James Ore Concentrator
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Smelting Machinery—
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drills—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A G., Germany
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd
G. Taylor Hardware Co., Ltd.

Steel—Tool—
Mussens, Ltd.
Thos. & Wm. Smith
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley
C. L. Berger

Switchboards—
Canadian Westinghouse
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.

Transformers—
Canadian Westinghouse
Can. Fairbanks-Morse Co.
Peacock Bros.
Siemens Co. of Canada, Ltd.

Transits—
C. L. Berger & Sons
W. F. Stanley
Peacock Bros.

Tractors—Oil—
Can. Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse
Peacock Bros.
Laurie & Lamb
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Winding Engines—
Waterous Engine Works
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Wire Cloth—
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Standard Underground Cable Co., of Canada, Ltd.

Wire—Magnet—
Standard Underground Cable Co. of Canada, Ltd.

Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher

LEGG BROS
ENGRAVING CO.
DESIGNING ENGRAVING
5 JORDAN ST
TORONTO CANADA

Detail of Oiling System for Motors

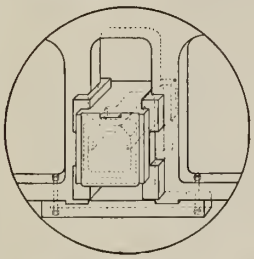


Diagram of Vauclain Gib

Vauclain Gib, removed.

One of the most important developments in the mining industry.

The new type Baldwin-Westinghouse Electric Mine Locomotive is an excellent example of the rapid progress that has been made during the past few years in the design of mining apparatus.

The Cast-Steel Bar Frame gives great strength with least weight; permits easy access to, and excellent ventilation for the motors.

The Vauclain Removable Gib greatly facilitates the removal of journal boxes and permits inspection or replacement of all wearing parts with a small cost of time and labor.

The Oil and Waste Lubricating System for the motors, with specially designed bearings for long life in service, has been adopted as standard after years of investigation.

The Commutating Pole Motors insure sparkless commutation at all loads. As a result, the commutator and brushes are long lived and require little attention; brush renewals are seldom required, and carbon and copper dust inside the motor is practically eliminated.

These features are but a few out of many which give the user the greatest possible service. You can obtain full information about these locomotives by addressing nearest office.

Canadian Westinghouse Co., Ltd.

Hamilton, Ont.

TORONTO — Traders Bank Bldg.
MONTREAL — 52 Victoria Square
OTTAWA — Ahern & Soper, Ltd.
HALIFAX — Telephone Bldg.
WINNIPEG — 158 Portage Ave. E.
CALGARY — Grain Exchange Bldg.
VANCOUVER — Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

— FOR REGULATIONS, MAPS, ETC., APPLY TO —

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M.A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— Published by —

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

— which also publishes —

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*
CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*
PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*
CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*
CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

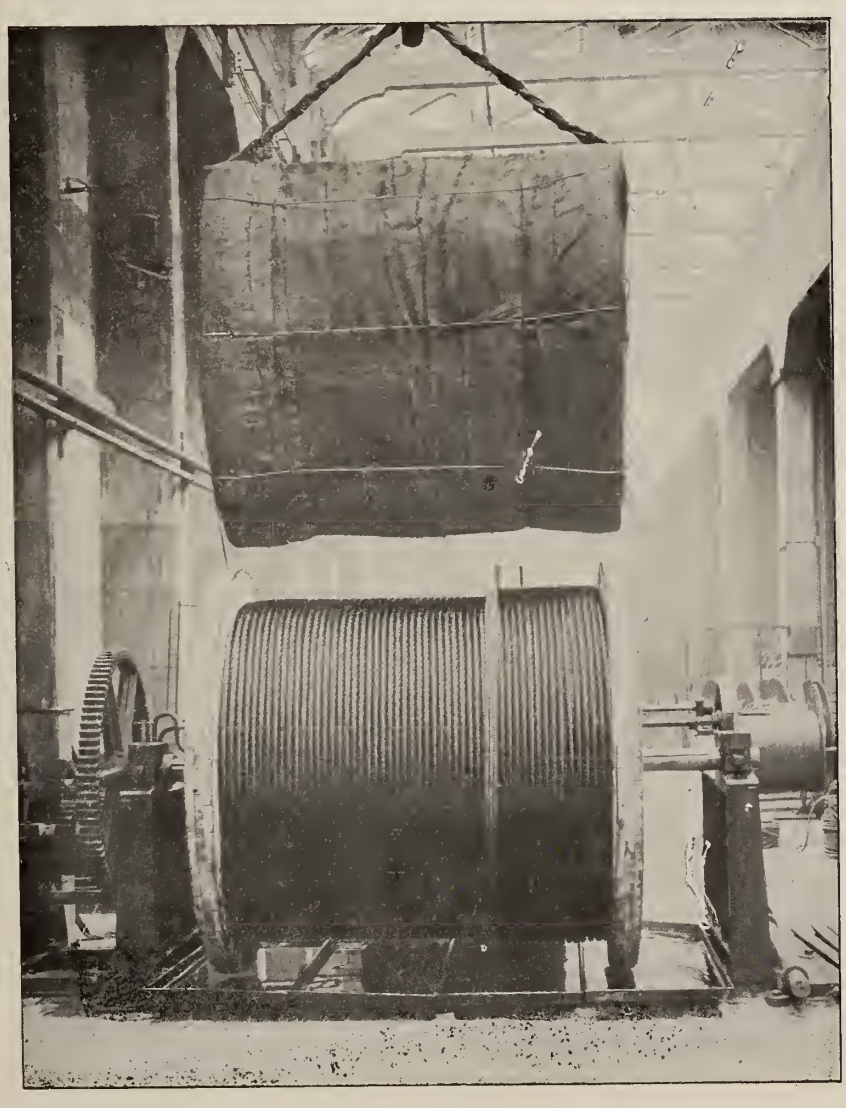
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

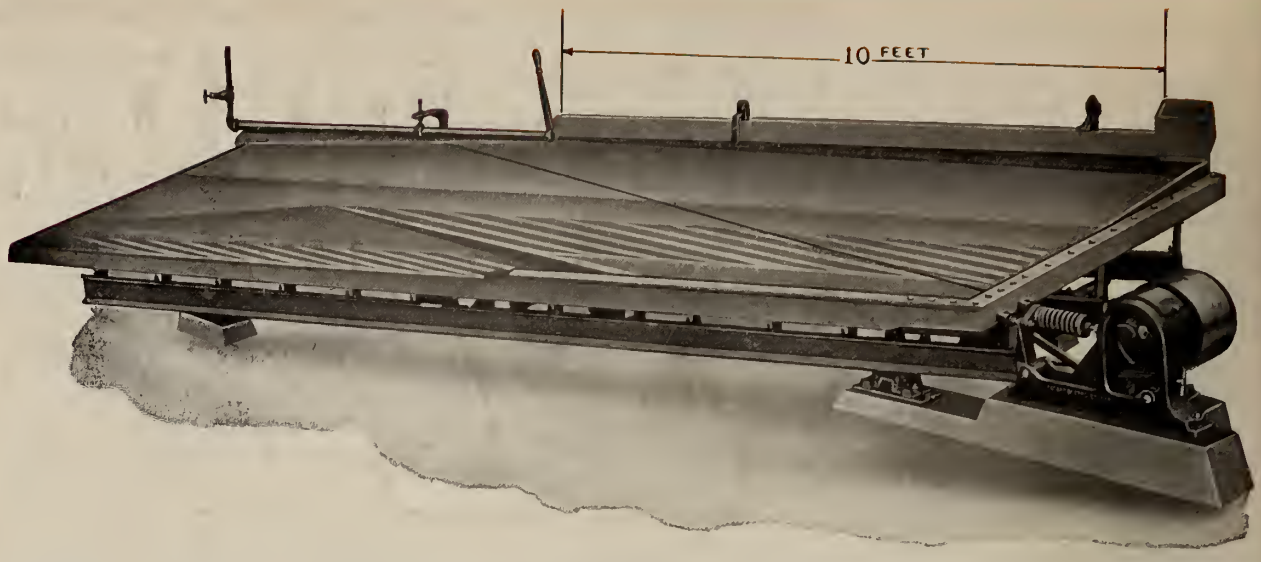
CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.

CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.



The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

The Best Explosive Yet !

"MOLE" BRAND

In a Class by Itself.

Made only by

Curtis's & Harvey
(Canada) Limited

Montreal
400 St. James Street

Cobalt
Royal Exchange Bldg.

APRIL 15, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 8

TIGHT MONEY

Has not Prevented Up-to-date Mine Managers from installing

HARDY - SIMPLEX
Hammer Drills

WHY? Because they are REAL ROCK DRILLS and live up to every claim made for them and so

SAVE MONEY

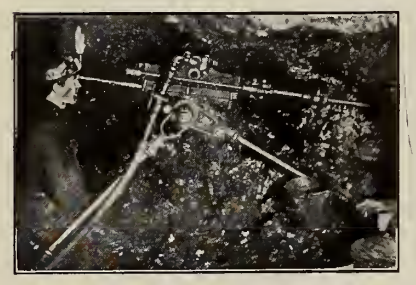
Try Them Yourself and See

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER 101 Water St.
QUEBEC 31 St. Louis St.
ST. JOHN, N.B. 57 Symthe St.
HALIFAX 78 Granville St.

The Byers Mark is the seal of highest pipe quality—the assurance of definite and lasting service satisfaction in every kind of pipe installation. It is stamped into each length and coupling of

BYERS GENUINE WROUGHT IRON FULL WEIGHT GUARANTEED PIPE



Toking iron ore from one of the Byers Mines

Ore steomer built and owned by Byers

Blost furnace owned ond operoted by Byers

In one of the Byers rolling mills

FOR fifty years it has stood for all that is highest and best in pipe history, in pipe manufacture, and in the records of pipe service. Never in all the fifty years of its life, has the Byers Mark been placed on a single length of pipe that was not full Standard weight.

Never, during this time, has a single ton of the Byers product been cheapened by the introduction of scrap or inferior pig iron of any sort. Byers pipe is made from Byers own ore, in Byers blast furnaces and rolling mills, entirely independent of any outside condition.

The careful, hand-controlled methods and standards that produced the "old-fashioned" wrought iron pipe so familiar to the older generation are to-day rigidly maintained in the Byers plants, although the equipment of these plants is now the most modern and efficient that can be found in the industry.

These methods are today turning out pipe of the same sturdy quality as the Byers Pipe of our fathers; pipe that will give, and is giving, the same lasting service as that recorded in the piece of pipe removed from the Pittsburgh Hump, after 28 years of continuous use. And there are thousands of just such outstanding demonstrations on record in every other field of pipe service.

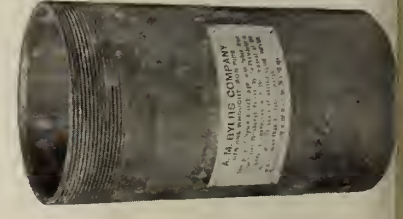
The year 1914 is the fiftieth anniversary of Byers. It marks the completion of a half century of flawless pipe service, in which there has been recorded no single instance of Byers failure to meet the most exacting requirements of actual installation.

Write for the Byers Book—"The Control of Quality in Every Process." It tells why the Byers Mark means so much to all pipe purchasers.

THE piece of pipe whose unretouched photograph is shown below was taken from Grant Street, Pittsburgh, in the removal of the famous Hump.

It had been underground for 28 years of uninterrupted service, and had lost not over 3% in weight.

The thread shown is the original cut in the Byers mill 28 years ago.



A·M·BYERS COMPANY

ESTABLISHED 1864

PITTSBURGH PA.

DISTRICT AGENTS AT

New York City	Boston	Cleveland	Toledo
Philadelphia	Detroit	Chicago	Cincinnati
Buffalo	Milwaukee	Portland, Ore.	San Francisco

Denve
Los Angele

Write for the nome of the Byers Deoler in your district. He con supply you immediotely.

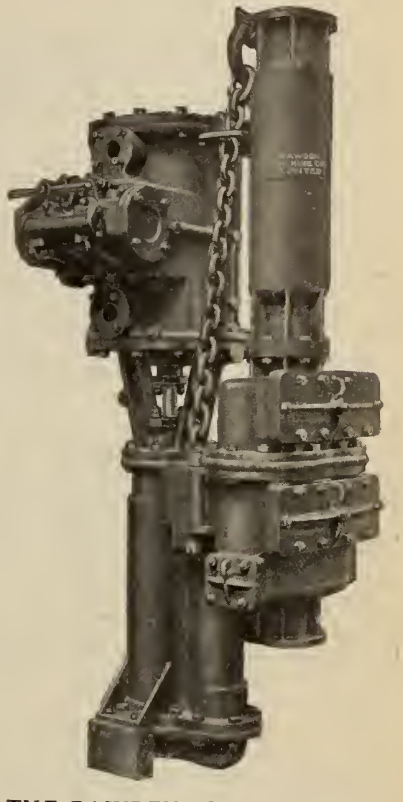
BAWDEN STEAM PUMPS

Cannot Short Stroke

THE STEAM END HAS NO TAPPETS

No springs. No internal tubes. No packing glands. No outside moving parts. Nothing to go wrong to adjust.

CANADIAN PUMPS that are guaranteed equal to any domestic or foreign pumps made.



THE BAWDEN SINKING PUMP
No Springs, Tappets or Outside Rods

MOST ECONOMICAL AND EFFICIENT

Let us quote you on a pump guaranteed to do your work. That will give a steady flow with no bang at any pressure. Will not get air-bound. Go as long as there is steam, and cost less to operate and maintain.

Erie Engines and Boilers, all sizes and for every requirement. Union Iron Works Water Tube Boilers—9 sizes from 100 to 500 H.P. Exeter Improved Organ Feed Water Heaters and Purifiers. Estimates furnished for complete steam plants.

FJAB Drill Steel, hollow or solid, stands for quality, uniformity, reliability, economy. Once adopted, always used.

Rock & Power Machinery

Limited

Agents in Canada for the Erie Engine Works, Union Boiler Works, and Exeter Machine Works. Complete Lines. Agents for the Gramm Motor Truck.

HEAD OFFICE: 12 King Street East, Toronto. Ont.

BRANCH OFFICES:

VANCOUVER; CALGARY; WINNIPEG; SUDBURY; COBALT; OTTAWA; MONTREAL; HALIFAX,
AND IN THE KING EDWARD HOTEL, TORONTO

Imperial Bank
of Canada
Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Subscribed	$7,000,000
Capital Paid Up	6,992,000
Reserve Fund	7,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

SAFE MINERS' SAFETY LAMPS
with Hailwood's Patent Impregnable Magnetic Lock

Manufactured by the Worlds' Safety Lamp Experts

ACKROYD & BEST, LTD.,
Morley, Leeds, England

Specialists in Miner's Lamps and Equipment for same; Hailwood's Patent Fool-proof, Flame-proof, Underground Relighting Machines; Lamproom Lighting and Unlocking Machines; Cleaning Machines; Filling Machines; Iron Lampstands; Cleaning Benches, etc., etc. For full particulars apply:

Ackroyd & Best, Ltd.
No. 2 Arrott Power Buildings, Barker Place,
Pittsburg, Pa., U.S.A.
Telephone Nos. { P. & A. Tel. Main 2217 / Bell " Grant 1619

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

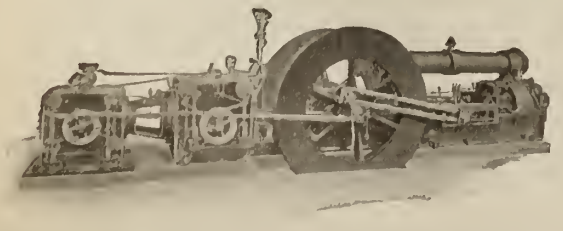
For Calendar and other information apply to the Secretary,
A. T. LAING

Less Costly Air

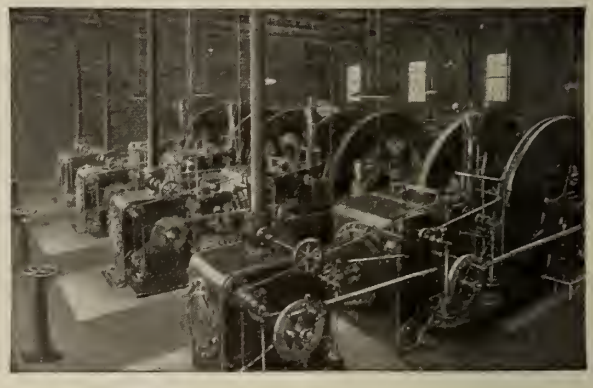
There's a Reason—
why well-known mines and manufacturers by the dozens use

Sullivan Corliss Tandem-Compound Air Compressors, Class "WC"

Sullivan "WC" Compressors are the most economical reciprocating machines on the market for turning coal into air power,—



"WC" Tandem Compound Corliss Two-stage Compressor



Four Sullivan 2500-ft. Tandem Corliss Compressors on a Catskill Aqueduct Tunnel

Because their steam economy is the same as that of the best cross compound compressors.

Because their price, weight, floor space and foundation cost are all less than these items in equivalent cross-compound machines.

Because we carry them in stock unit sizes from 1000 to 3100 cu.ft., for prompt shipment.

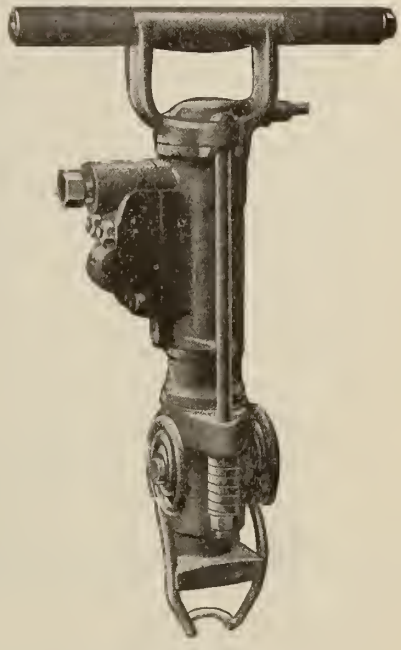
If interested in "Less Costly Air," send for Bulletin 658-D.

Rock Drills Diamond Drills Hammer Drills Coal Cutters

Sullivan Machinery Co.
122 So. Michigan Ave. - Chicago, Ill.

THE JACKHAMER

IS SELF-ROTATING, SELF-LUBRICATING, AND IT IS AN ALL-STEEL DRILL OPERATED BY STEAM OR AIR.



The Jackhamer—
Used extensively for sinking and down holes of moderate depth.

In the "JACKHAMER" are those qualities so essential to the low cost of drilling rock.

The all-steel construction with the automatic lubrication protects users against excessive repair costs because the parts are all practically indestructible and are automatically given proper oiling.

As to drilling costs, the "JACKHAMER" has a great advantage over the mounted drills, inasmuch as a wide range of drilling records show that from 40 to 60 per cent. of drilling time with piston machines is consumed in changing holes, setting up, etc.

Whereas, with the "JACKHAMER" from 80 to 95 per cent. of the drilling time is consumed in actual drilling, with the result that the "JACKHAMER" is very materially reducing drilling costs. It is also being universally accepted as an improved method over the heavier machines for work to which it is applicable.

What a user of the JACKHAMER says:

"We now have in use two of your "Jackhamer" steam drills, both of which are giving entire satisfaction. They are the only hammer drills we have ever seen that work successfully under steam pressure, and they are the only machines we ever saw that would cut a hole as deep as 6 feet without more or less trouble."

Send for Pamphlet K-68 which describes the JACKHAMER.

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

Send Us the Particulars of Your Requirements

Blake Crushers	Shoes and Dies	Trommels
Dodge Crushers	Stamp Batteries	Roasters
Gyratory Crushers	Compressors	Dryers
Crushing Rolls	Hoists	Smelting Furnaces
Huntington Mills	Engines	Converters
Chilian Mills	Boilers	Centrifugal Pumps
Tube Mills	Jigs	Steam Turbines

Prompt shipment on standard Machinery. Write for Bulletins on the subject which interests you.

FRASER & CHALMERS OF CANADA

4 PHILLIPS PLACE LIMITED MONTREAL, P.Q.

MORGAN BATTERSEA CLAY GOODS

Muffles, Crucibles, Scorifiers, Cupels, Furnaces, Etc.

Known the world over as best, having certain features which ever commend them to all users of high-class goods.

MORGAN PLUMBAGO CRUCIBLES

For melting Gold, Silver, Copper, Steel and other metals, are of superior quality, have great uniformity and are favorably known for their power of resisting extreme heat without the danger of cracking from sudden changes.

CHLORIDE OF LIME

Needed for the Spring clean up. In drums, barrels, kegs and smaller packages.

WAUGH STOPING DRILLS

Manufactured by the Denver Rock Drill Manufacturing Co., Denver, Colorado

THE MODEL 16V WAUGH STOPER

is carried in stock by us and sold with the guarantee that it will do more work for you than any other stoper you have or can get. Proved the best by many tests. Write for information and prices.

THE GEORGE TAYLOR HARDWARE CO. LIMITED

NEW LISKEARD (Head Office) COBALT COCHRANE

Periodicals Which Cover Exclusively Canada's Basic Industries

Canadian Mining Journal

Devoted to the industry and science of mining and metallurgy. Published twice a month. Subscription, $2.00 a year to any address in Canada and $3.00 elsewhere.

Pulp and Paper Magazine

Devoted to the industry and science of Pulp and Paper making. Published twice a month subscription, $2.00 a year to any address in Canada. Elsewhere $2.50.

Canadian Textile Journal

Devoted to the manufacture of Textiles and the science of Textile Fibres. Subscription, $2.00 a year to any address in Canada. Elsewhere $2.50.

Canadian Miller and Cerealist

Devoted to the industry of Milling, Practical Flour Milling, and to the science of Grain and Grain Products. Published monthly. Subscription, $1.00 a year to any address in Canada. Elsewhere. $1.50.

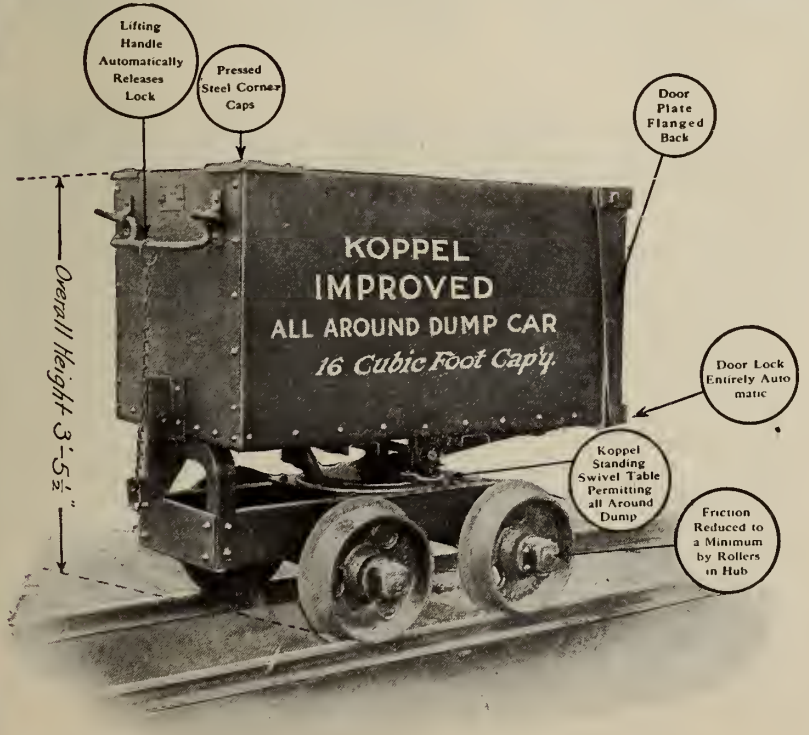
Canadian Fisherman

Devoted to the industry of Fishing, the science of Fish Culture and the use and value of Fish Products. Published monthly. Subscription $1.00 a year to any address in Canada. Elsewhere $1.50.

All communications regarding any of the above magazines will receive prompt attention when addressed to any of the following offices:

35-45 St. Alexander St., Montreal, Que. 44-46 Lombard St., Toronto, Ont. 206 Broadway, New York, N.Y.

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Capy.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N.B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

HADFIELDS
LIMITED
SHEFFIELD

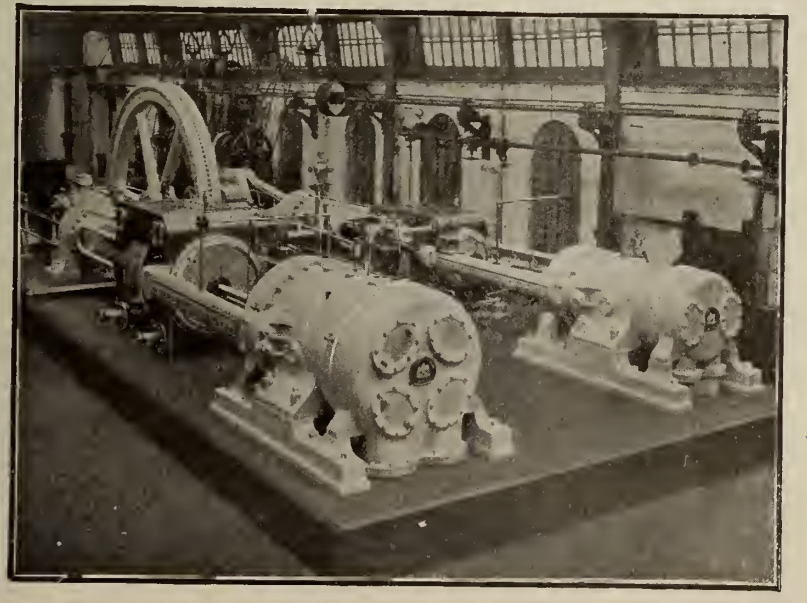
STEEL CASTINGS
of Every Description

Send for Bulletin No. 79

SOLE MAKERS
OF
HADFIELD'S PATENT
"ERA"
MANGANESE STEEL
THE SUPREME METAL
FOR WEARING PARTS

SOLE AGENTS
Montreal **PEACOCK BROTHERS** Vancouver

WALKER BROTHERS (WIGAN)
LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES
With Valves to Recent Patents

THE
"WALKER" COMPRESSOR
is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

FOR SALE

Steam Hoisting Engines and Pumps

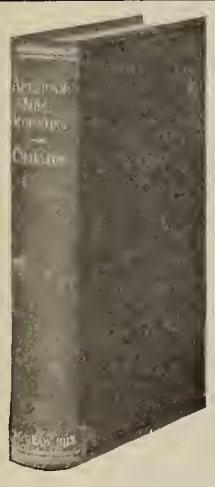
The following machinery has been put out of service by an electric installation and is offered for immediate delivery, f.o.b. cars Stellarton, Nova Scotia.

1 Novelty Iron Works Steam Hoisting Engine. Duplex cylinders, 16″ diameter by 42″ stroke. Geared to 2 cast iron drums 9′ diameter by 56″ wide. Gear ratio 3 to 1, also 6,500′ of 1″ steel cable.

1 I. Matheson and Company's Steam Hoisting Engine, duplex cylinders, 16″ diameter by 30″ stroke. Geared to 2 cast iron drums 9′ diameter by 54″ wide. Gear ratio 2.4 to 1.

1 Jeansville Duplex Triple Expansion Pumping Engine, Steam cylinders 19″, 27″ and 44″ diameter, by 36″ stroke. Water cylinder 9″ diameter, together with jet condenser and condenser pump. Outfit capable of handling 1,000 gallons per minute against 1,800 feet head. Very low prices.

Address
Acadia Coal Company, Limited,
Stellarton, N.S.



American Mine Accounting

By W. H. CHARLTON, Member of Lake Superior Mining Institute.

367 *pages*, 6*x*9, $5.00 (21*s*) *net, postpaid.*

A collection of methods in actual use by representative companies. They cover a wide enough variety of work to fairly cover the field.

Over 250 blank forms are presented.

Each section discusses first operating conditions, and then takes up the various accounts—General Ledger, General Cost, Administration, Distribution, Shop, etc., etc.

FOR SALE BY

CANADIAN MINING JOURNAL -:- 44 and 46 Lombard Street

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

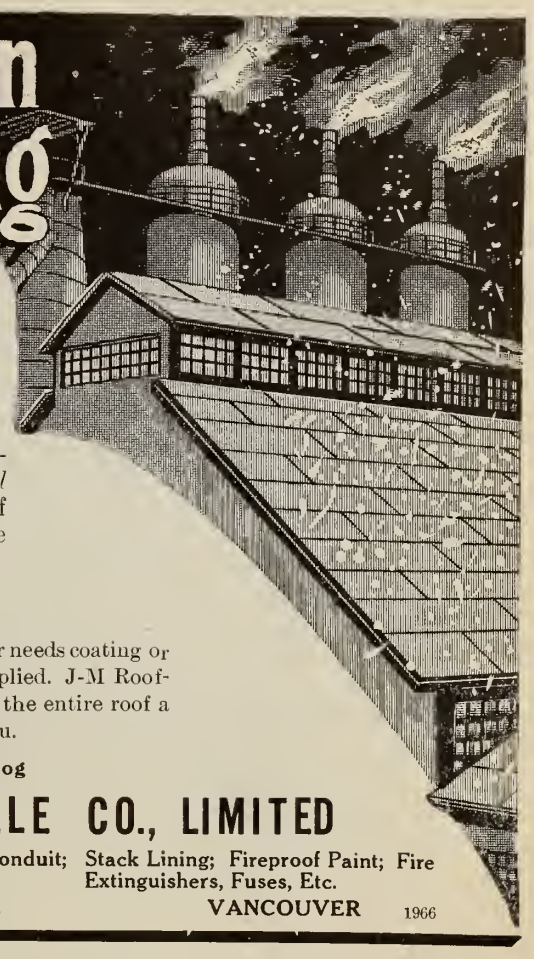
43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

Sparks can not burn J-M Asbestos Roofing



On the plant of the Medina Foundry Co., Medina, O., J-M Asbestos Roofing has for years withstood a *continuous shower of sparks* from a cupola stack.

Scores of cases are on record to prove that J-M Asbestos Roofing has saved buildings from destruction by resisting the action of burning brands and embers blown from adjacent fires.

J-M Asbestos Roofing affords *perfect fire protection.* Fire, chemical fumes and weather have no effect on it—because it is *all mineral*, and therefore practically indestructible. Composed of layer upon layer of Asbestos Felt cemented with Trinidad Lake Asphalt. Literally a sheet of *pliable stone.*

Cheapest-per-year Roofing

J-M Asbestos Roofing contains nothing to rust, rot, peel or crack. Never needs coating or graveling. *Its first cost is the only cost.* Adapted to all buildings. Easily applied. J-M Roofing Cleats, packed in each roll, make absolutely watertight laps and give the entire roof a handsome white appearance. We ship direct if your dealer can't supply you.

Write nearest Branch for Illustrated Catalog

THE CANADIAN H. W. JOHNS - MANVILLE CO., LIMITED

Manufacturers of Asbestos Roofings; Pipe Coverings; Packings; Mastic Flooring; "ASBESTOS" Conduit; Stack Lining; Fireproof Paint; Fire Extinguishers, Fuses, Etc.

TORONTO MONTREAL WINNIPEG VANCOUVER 1966

SARTORIUS

BALANCE

MODEL

"AMERICA"

WRITE FOR DESCRIPTIVE CIRCULAR

LYMANS, LIMITED

MONTREAL

Different

kinds of work require different tools —we make a specialty of

Stope Drills

only, and know that our continuous efforts to produce the most efficient and most economical Stope Drill on the market have met with wonderful success.

The "Cleveland"

receives universal praise wherever it is seen or tried. Can we send you an equipment for 30 days' trial?

Fully described in Bulletin No. 30

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street, TORONTO

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

GREENING'S WIRE ROPE

Our Mining Ropes are especially constructed to suit the requirements for HOISTING or HAULING.

Crucible Cast Steel
Best Plow, Acme Brand,
extra high breaking strain for deep shafts.

Regular Lay Lang's Lay

Wire Rope Fittings
Wire Rope Grease

ASK FOR OUR ROPE CATALOGUE

The
B. Greening Wire Co.
Limited

Hamilton, Ont. - Montreal, Que.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 1 4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: **NEW GLASGOW, NOVA SCOTIA**

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Continuous Operation Without Attention

An abundance of oil from the reservoir is supplied continuously to all bearings. It has a simple valve gear. The side-crank design places the fly wheel or driving pulley between two bearings which are easily kept in line.

INTERNATIONAL ENGINEERING WORKS, Ltd.

WORKS AT
Amherst, N.S.

So. Framingham, Mass.

39-69

Montreal
Toronto
Edmonton
Winnipeg
Cobalt

"BEATTY HOISTS"

Clamshells, Derricks, Centrifugal Pumps, Etc.

If you need a Clamshell for any purpose, we can furnish it quickly—most likely we have it in stock.

Can also supply any standard size Hoist, with single, double or triple drums—FROM STOCK.

Let us know your requirements—we'll do the rest

M. BEATTY & SONS, LIMITED
WELLAND, - ONTARIO

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records

Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

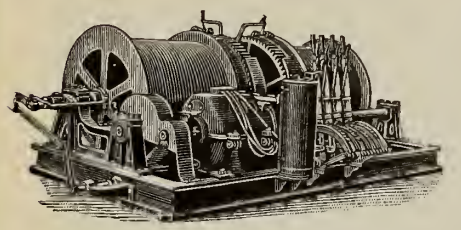
HEAD OFFICE AND FACTORY **TORONTO** BRANCH FACTORIES **WINNIPEG** AND **MONTREAL**

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

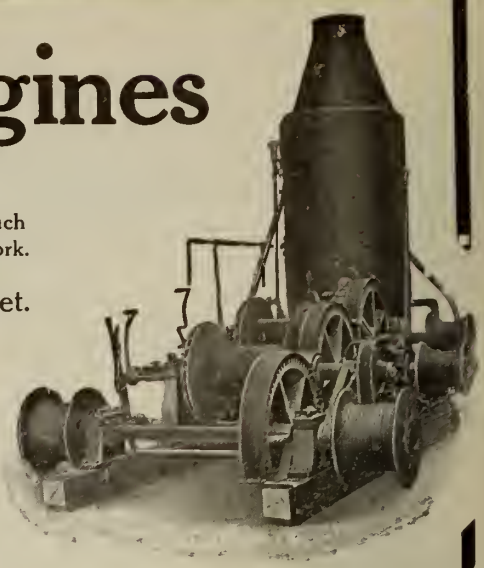


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

Office and Works: BANGOR, Pa., U.S.A.

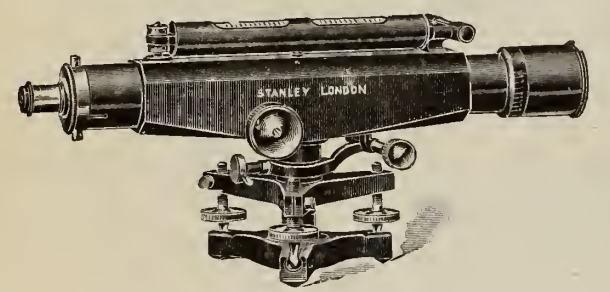
SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

Trade **STANLEY** Mark



Stanley's Quick-Setting Dumpy Level

The largest manufacturers of **SURVEYING and DRAWING INSTRUMENTS** in the world.

DRAWING OFFICE STATIONERY of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our "K 35" Catalogue (post and duty free) and compare our prices with those of other first-class makers.

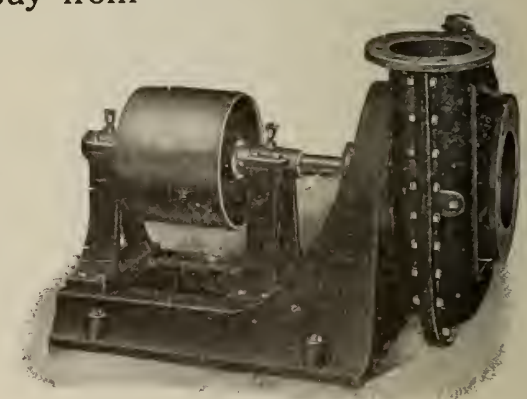
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, High Holborn, W.C.

Head Offices and Showrooms:
286, High Holborn, London, W.C., England

What more can be desired for the use of your money than first-class workmanship and material?

This is what you get when you buy from



The Smart Turner Machine Co.

LIMITED

Hamilton, Canada

All Ready!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets.
Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

GOLD

Its Geological Occurrence and Geographical Distribution

By MALCOLM MACLAREN

This is an excellent treatise, carefully written by a well-known authority on gold deposits.

It is the most comprehensive work on the subject, and contains authentic descriptions of gold deposits in all parts of the world.

Accuracy and brevity are notable features.

The volume is well printed and contains 278 illustrations.

The price is $7.50.

Book Department, Canadian Mining Journal

44-46 Lombard Street, Toronto

Lindgren— # MINERAL DEPOSITS

For Sale by the

Canadian Mining Journal

44-46 Lombard St. Toronto

By WALDEMAR LINDGREN, Professor of Economic Geology, in in charge of the Department of Geology, Massachusetts Institute of Technology; Geologist, United States Geological Survey.

883 *pages, 6x9, 257 illustrations,* $5.00 (21s) *net, postpaid*

For many years Mr. Lindgren has been Geologist of the United States. Geological Survey.

In this time he has come to be generally recognized as the leading authority on ore deposits.

The publication of this work on "Mineral Deposits" has been anticipated throughout the world.

It is the first book to attempt to cover within reasonable space both metallic and non-metallic minerals, except coal and oil.

— CONTENTS —

Introduction.
Deposition of Minerals.
The Flow of Underground Waters.
The Composition of Underground Waters.
The Chemical Work of Underground Waters.
The Origin of Underground Water and its Dissolved Substances.
The Spring Deposits at the Surface.
Relations of Mineral Deposits to Mineral Springs.
Folding and Faulting.
Openings in Rocks.
Form, Structure and Texture of Mineral Deposits.
Ore Shoots.
Classification of Mineral Deposits.
Deposits Formed by Mechanical Processes of Transportation and Concentration; Detrital Deposits.
Deposits Formed by Chemical Processes of Concentration in Bodies of Surface Waters.
Deposits Formed by Evaporation of Bodies of Surface Waters.
Deposits Formed by Processes of Rock Decay and Weathering.
Deposits Formed by Concentration of Substances Contained in the Surrounding Rocks by Means of Circulating Waters.
Deposits Formed by Regional Metamorphism Formed by Zeditisation.
Deposits of Native Copper in Basic Lavas.
Lead and Zinc Deposits in Sedimentary Rocks in their Genetic Connection with Igneous Rocks.
Deposits Formed Near the Surface by Ascending Thermal Waters and in Genetic Connection with Igneous Rocks.
Deposits Formed at Intermediate Depths by Ascending Thermal Waters and in Genetic Connection with Intrusive Rocks.
Veins and Replacement Deposits Formed by Hot Ascending Waters at High Temperature and Pressure and in Genetic Connection with Intrusive Rocks.
Deposits Formed by Processes of Igneous Metamorphism.
Mineral Deposits of Pegmatite Dikes.
Mineral Deposits Formed by Concentration in Molted Magmas.
Metamorphosed Deposits.
Oxidation of Metallic Ores.
Calculation of Analysis and Representation by Diagrams

MINE RAILS

12 to 45 Pounds

PROMPT SERVICE.

H. A. DRURY CO.

LIMITED

MONTREAL and TORONTO

Are you insured against this loss?

Millions of dollars have been lost during the past winter in the manner shown in the picture, which was taken in Cleveland, O., last November.

Why not insure your company against such loss by installing your electric wires underground.

Now is the time to plan this work. *Write our nearest office to-day.*

Standard Underground Cable Co., of Canada, Limited
Hamilton, Ont.

Montreal, Que. Winnipeg, Man.
Boston, Mass. Seattle, Wash.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade manganese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

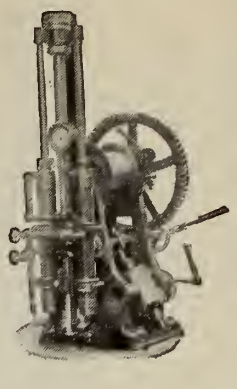
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

CHAIN-BLOCKS ALL SHIPPED THE DAY ORDER IS RECEIVED.

THE HERBERT MORRIS CRANE & HOIST CO., LIMITED,

EMPRESS WORKS, PETER STREET, TORONTO, ONT.

BRANCH OFFICE, CORISTINE BLDG., MONTREAL. QUE.

POSITION WANTED

As superintendent or foreman, by one who has had wide experience in Mechanical Construction, Draughting, Designing and Erecting of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc. References. Will accept small salary until value of services is demonstrated.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

BOOKS

Make use of the experience of others by reading the best technical books.

A good library will help you.

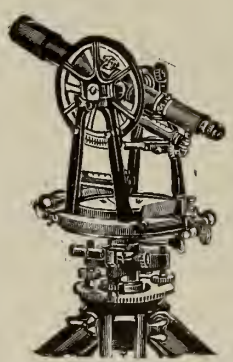
BOOK DEPARTMENT
CANADIAN MINING JOURNAL
44-46 Lombard Street, Toronto

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.



Berger TRANSITS AND LEVELS

Latest designs in Instruments for Underground Surveying for all classes of work. Complete Catalog fully describing and illustrating these instruments, with **a large Manual giving full and concise directions** in the **care, use** and **adjustment** of instruments will be sent on request.

C. L. Berger & Sons, Boston, Mass., U.S.A.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

—SEND FOR CATALOGUE—

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

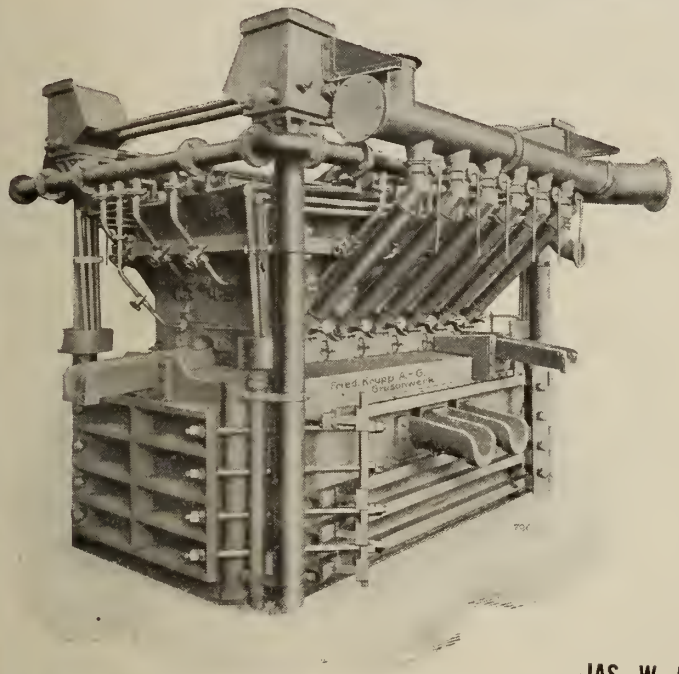
DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

FURNACES AND ACCESSORIES FOR SMELTING PLANTS AND METAL WORKS.



Sinter Roasting Furnaces, Water Jacketed Furnaces, Converter Plants, Refining Furnaces, Desilvering Plants, Gold Refining Plants, Blast Furnace Hoists, Fore Hearths, Slag Trucks, &c. :: :: :: :: ::

Equipment for Recovering Metal from Sweeps and Junks.

REVERBERATORY MELTING FURNACES. for Fining and Re-melting Copper, Brass, &c.

Crucible Furnaces, Re-heating Furnaces, Annealing Furnaces, Gas Producers, &c.

FRIED. KRUPP A.-G. GRUSONWERK

Magdeburg, (Germany.)

CANADIAN REPRESENTATIVES

JAS. W. PYKE & CO., LIMITED. 232 St. James Street, MONTREAL

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

B. K. MORTON & COMPANY

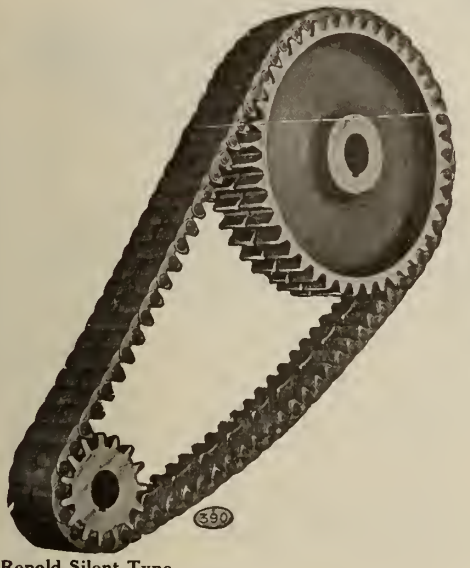
SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD STEEL DRIVING CHAINS

For All Purposes



Renold Silent Type

Save Power, Space and not affected by Heat, Cold or Moisture.

Write for Illustrated Catalogue

Renold Roller Type

JONES & GLASSCO (Reg'd) Engineers

Sole Canadian Agents

Branch Office, Toronto

49 Place D'Youville, MONTREAL

A Practical Success for Picking Table Service in Handling Coal, Ores, Stone, Gravel, etc.

JEFFREY DOUBLE-BEADED STEEL APRON CONVEYERS

The double beading of the flights not only stiffens the apron, but preserves its shape, and provides a close tight joint.

Furnished with or without vertical retaining ends, constructed of a series of plates lapped "shingle fashion" in the direction of the travel of the conveyer, to further insure against leakage.

Apron Sections carried on Double Strand Steel Thimble Roller Chains—especially adapted to this service.

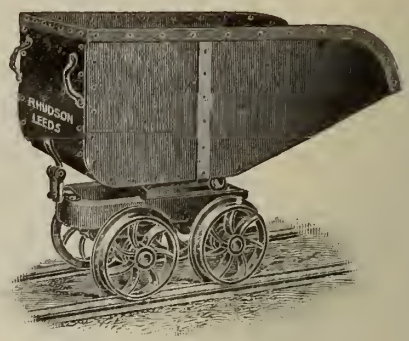
These picking tables are built in sizes and widths to suit capacities for large or small mines. Self-contained, and may be installed in tipples already constructed.

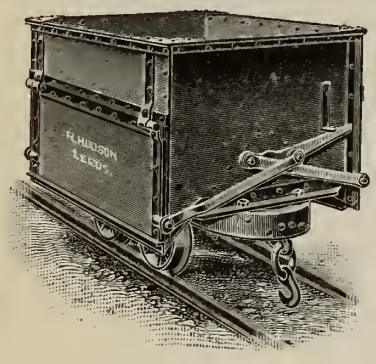
With JEFFREY COMBINATION PICKING TABLES AND LOADING BOOMS, all Grades of Coal can be Loaded to Railroad Cars with Practically No Breakage. Write for Descriptive Bulletin No. 45.

THE JEFFREY MANUFACTURING COMPANY

Canadian Main Office and Works : MONTREAL

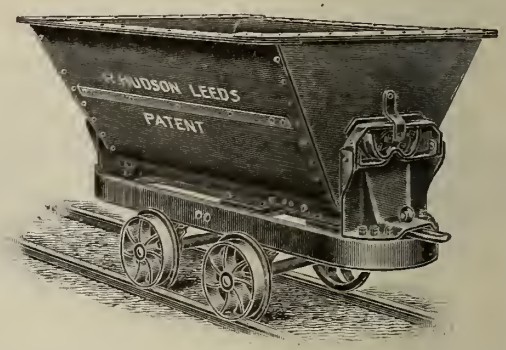
HUDSON MINE CARS

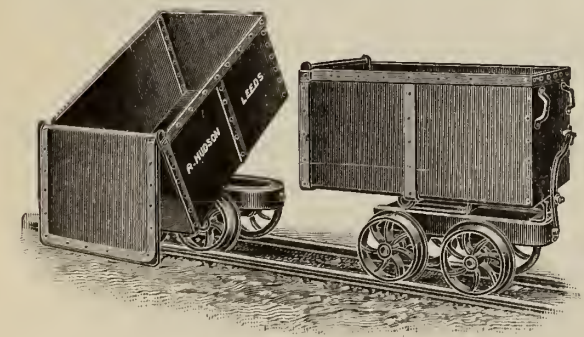




Are fitted with Cast Steel Wheels with dust-proof caged Roller Bearings with Oil Reservoirs.

Improved Side and End Tip Cars
Scoop Rotary V-Shape





Gable Bottom, Etc., Etc.
Suitable for either underground or surface work
CARRIED IN STOCK

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, April 15, 1914. No. 8

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

Editorial—	Page
Mining Accidents in Ontario	253
Porcupine	254
Weekly Pay	254
The Vancouver Island Riots	254
Omineca River District, B.C.	255
A Mining Engineer of the Fifteenth Century, by F. W. Gray	256
The Influence of Nickel on Some Copper Alloys	258
Tough-Oakes Gold Mine, Kirkland Lake, Ontario, by R. E. Hore	259
Vancouver Island Riot Cases	264
The Mineral Production of Quebec in 1913, by T. C. Denis	265
Hedley Gold Mining Co., Annual Report	266
The Electrical Driving of Winding Engines and Rolling Mills, by A. Ablett and H. M. Lyons (continued)	268
Wages Paid to Michigan Mine Workers	274
Book Reviews	278
Personal and General	279
Special Correspondence	280
Markets	288

MINING ACCIDENTS IN ONTARIO

The recently issued report by Mr. T. F. Sutherland, Chief Inspector of Mines, on Mining Accidents in Ontario in 1913, shows that very unsatisfactory conditions exist. The number of fatalities is unreasonably large, and it is evidently necessary that much greater attention must be given to the problem of preventing accidents. Every mine manager takes precautions to ensure safety; but the record shows that additional precautions are necessary. Most miners observe the regulations which are made to ensure safety; but the record shows that many of them do not.

During 1913 there were 64 fatal mining accidents in Ontario. Forty-five of these occurred in mines, 11 in metallurgical works, and 8 in quarries. Mr. T. W. Gibson points out that isolated or spasmodic work in the early stages of mining development, where the system and discipline attaching to well equipped and full-scale operations are wanting, carries a proportionately higher accident rate.

Mr. Sutherland states that the total number of serious accidents in and about the mines of Ontario reported to the Bureau of Mines in 1913, was 353, resulting in 45 persons killed and 320 injured; of these accidents 284 occurred underground, and 69 above. The fatal accidents took place in mines operated by 19 different companies, the same number as in 1912. At metallurgical works there were 212 accidents which caused the death of 11 and serious injuries to 201 men. At quarries there were 18 accidents which caused the death of 8, and serious injuries to 12 men.

Commenting on the year's record, Mr. Sutherland says: "While it is to be hoped that the number of deaths from accidents is abnormal for the year 1913, yet it will be seen that a large number are the result of want of proper care on the part of the workmen and those in charge, and also a lack of proper appreciation of the risks inherent to the nature of the industry. Sixty-five per cent. of the fatal accidents during the year could have been avoided by the exercise of greater caution on the part of the workmen, and by the mine operators insisting on a strict enforcement of the Mining Act. There are several mines in Cobalt which have a good record, especially during the past two years. These mines must necessarily employ the same class of labor as adjoining properties, yet their accident rate is much lower than the average of the camp.

"An example of what can be accomplished in accident prevention by intelligent effort is furnished by the Canadian Copper Company, at Copper Cliff. Mr. E. T. Corkill, formerly Chief Inspector of Mines for the Province of Ontario, was appointed Safety Engineer for this com-

pany on July 1st, 1913. The accident lists published in this report show that for the first six months of 1913, this company had 11 men killed; for the last six months, 3. Of serious accidents which incapacitated the workmen for over five weeks, the first six months shows 40 men, and the last six months, 17. A corresponding decrease is noticed in the minor accidents.

"To decrease the accidents requires as honest an effort as to decrease the costs, or to increase the production. To issue general rules without seeing that these rules are observed may be a protection in damage suits, but will not diminish the number of accidents."

It is clear that many of the accidents might have been prevented. If conditions are to be improved the miners must be taught the necessity of greater care and the managers must insist on the enforcement of the regulations. Many managers and many miners are careful. Some are not.

Possibly the fault is that the mines are not inspected frequently or carefully enough. The inspectors are faithful in the performance of their duties, but there are not enough of them.

PORCUPINE

The gold mines at Porcupine are showing up remarkably well as development progresses. There is now no doubt whatever that a large production can be profitably made.

The Hollinger and Acme will both yield handsome profits from operations, both having fairly high-grade ore and a lot of it. On a smaller scale the Porcupine Crown is also doing well. The McIntyre has been less fortunate until lately; but better ore has recently been encountered. These properties are at present in a condition which augurs well for the future of the Pearl Lake section of the Porcupine district.

At the Dome mine the ore is considerably lower grade than at the Hollinger, but it has been proven that the deposit is very large.

Porcupine never looked as well as it does to-day. Its future as a gold producing district for many years is assured.

WEEKLY PAY

The members of the Provincial Workmen's Association are pressing the Nova Scotia Government to enact legislation providing for weekly pays instead of the bi-monthly pays now customary in Nova Scotia. The attitude of the coal companies can hardly be favorable to the request. At the mines of the Dominion Coal Co. during the summer of 1913 the average daily output in the week following pay-day was 1,800 tons less than the average daily output in the week preceding pay-day. On the Monday following pay-day it is not unusual for 1,500 men to absent themselves from work, and the output will fall from the maximum of 18,000 tons on the day before pay, to about 14,000 tons on the day after pay. This theme could be greatly enlarged upon, because it touches many debatable points having to do with social conditions, and it is largely bound up with the utterly preposterous liquor laws of Nova Scotia, and their utterly farcical administration, or it would be more correct to say their non-administration. If the coal companies oppose a change from fortnightly pays to weekly pays, it is because they fear two dislocations of their operations compared with one. The extra cost for clerical labor involved in a change from fortnightly to weekly pays is no bagatelle, but to put the matter frankly and even brutally the great fear of the operator is the "pay-day drunk." Imagine the moral obliquity of a community which legislates that liquor shall not be sold, and then with cynical deliberation sets to work to "milk" the liquor seller by means of fines, mutually arranged to help the local finances and yet not discourage the liquor-seller too much. Why not admit the necessity for the sale of liquor, license it and control it. Anything would be better than the present immoral and hypocritical attitude of the public towards the liquor traffic, which forces men to drink fearful decoctions in the vilest surroundings, and makes a lawbreaker out of every man who wishes to do something that in many countries is part of everyday social etiquette.—F. W. G.

THE VANCOUVER ISLAND RIOTS

The Vancouver Island strike riot prosecutions by the Government of British Columbia have been ended. In one case—that of an Italian organizer, sent by the United Mine Workers of America from Ohio to work in the interests of that body—an exemplary punishment of four years' imprisonment with hard labor was meted out, the activities of the convicted man having been adjudged largely responsible for the worst of the excesses committed at Extension colliery by the strikers. Other convicted men were sentenced to various terms of imprisonment, a number of them to one year in a Provincial jail, a few to longer terms, others to shorter periods, and still others were given their freedon on suspended sentence during good behavior.

In all, 217 persons were arrested, this number including a few youths. In connection with disturbances at Extension there were 50 arrested, at Ladysmith 73, at Nanaimo 76, at Cumberland 6, and at South Wellington 12. Altogether 164 were committed for trial at a higher court, nine were dismissed, and charges against 44 were withdrawn.

The cost of the prosecutions has been roughly estimated at $150,000, but the figures are unofficial. Then there has been a large expenditure in connection with keeping the militia in the strike zone. Prominent business men of Nanaimo and Ladysmith urge the retention of the militia, fearing a renewal of disturbances if the uniformed men be removed.

One mine-owning company only—the Vancouver-Nanaimo Coal Mining Co.—has recognized the United Mine

Workers of America. It is claimed that about 300 members of the United Mine Workers are employed at that company's Jingle Pot mine, near Nanaimo. This company's production operations have been the smallest of the four companies operating on the island; further, its reserves of coal are also stated to be small—less than two years' supply, it is asserted. The Canadian Collieries (Dunsmuir), Limited—with which company the labor troubles of the last eighteen months originated—operating the Comox (Cumberland) and Extension collieries; Western Fuel Co., operating the No. 1 Shaft, Protection Island, Brechin, and Reserve Shaft mines, all in the vicinity of Nanaimo; and the Pacific Coast Coal Mines, Ltd., owning the South Wellington colliery, and the newly-opened Morden and Suquash mines—the latter situated in the northern part of the island—are together employing a comparatively large number of men, stated to reach a total of about 1,900 in all. Such seems to be the situation to-day—300 United Mine Workers of America men working at Island mines against 1,900 non-members of the organization that forced this disastrous strike on Vancouver Island. Further, more non-members of the United Mine Workers of America are available for work in the coal mines than there is work for at the present time. The demand for coal is now less than the supply, so that the mines are not being worked full time.

What the future will bring forth, it is not possible to forecast, for the United Mine Workers of America supporters are reported to be positive they will eventually compel recognition of their organization and secure its terms for its members, while the companies, with the one exception mentioned above, are stated to be fully determined not to recognize the United Mine Workers of America nor to concede its demands. So it appears that by no means has the trouble been disposed of. So long as the United Mine Workers of America continues to support its local members by giving them strike allowances, and so long as any considerable number are content to subsist on that aid, the trouble will remain. One deplorable result is that the Western Fuel Co., which was not in any way responsible for the trouble, is the heaviest loser, with the Pacific Coast Coal Mines, Ltd., also a loser, though in a much smaller degree. For the present, then, a final settlement of the dispute is certainly not in sight.—E. J.

OMINECA RIVER DISTRICT—BRITISH COLUMBIA.

As placer-gold mining in what is known as Omineca River district is again attracting attention, the following information from the official report for 1913 of F. C. Swannell,* British Columbia land surveyor, who spent the field season of last year in the district, will likely be of interest:

"I have no hesitation in predicting a great future for the great Finlay-Parsnip River valley. Agricultural development will result in an impetus to the mining industry. Up to now prospecting has been almost entirely confined to search for placer-gold. Leads of copper ores and galena have been discovered close to Manson creek, and would be worked were the transportation facilities into the country bettered. A salt spring and lick was discovered 14 miles from Bulkley House on the Driftwood trail.

"The Omineca district is now entered by pack-trail from Hazelton. From Fort Babine to Manson much of the trail is very stony, with numerous steep pitches, and was very muddy, there having been more rain than usual this year. A wagon road is being built from Tacla lake to Silver creek by Mr. Bodine, about ten miles having been slashed and cleared this year. It is reported that a small gasoline steamer will be put on between Fort George and Tacla next season. During the old mining days supplies were brought in largely from Quesnel to Stuart lake, and thence by trail to Manson creek. This trail has not been kept in repair of late years. It is, however, splendidly located, dry, and the feed good, the only steep grade being at Lookout mountain. A wagon road could economically be built following this route. No trails enter the Manson creek region from the east, excepting the Moody trail from Fort Grahame. This crossed the Omineca below the Black canyon and crosses the summit of the Wolverine mountains at an altitude of about 5,500 ft. It is a very poor trail, with much soft ground, fallen timber and very steep grades over the mountain. A trail having as its ultimate object the Parsnip river runs down Manson creek to a short distance below the lower lake. The cutting of this trail through to Parsnip river is very advisable. I am informed by Mr. Steele, the mining recorder, that the country between the end of the trail and the Parsnip is good. The settlers at the junction of the Finlay and Parsnip rivers (which together form the Peace river) get their supplies from Fort George by way of Giscome Portage and Fort McLeod, but in my opinion a better way would be by the Peace river. A steamer now runs to Hudson Hope, below the Rocky Mountain canyon. A small steamer above plying on the upper Peace and Finlay would pay, especially if a wogan road were built in to Manson creek.

"The old placer-workings at Manson, Germansen, Vital, and Tom creeks were visited. At present placer-mining is being done on Manson and Germansen creeks and some quartz-mining near Fall river. Some 40 white men all told were working in this section, and a well-equipped prospecting party of five men was encountered on Stranger river. Much ground known to be auriferous will remain unworked until transportation facilities shall be improved. At present it is very difficult to get supplies or machinery in from outside, every pound having to be brought in by pack-horse or toboggan. In spite of this handicap, several hydraulic plants and two sawmills have been installed, although the latter have not been worked for some years. Easy communication with Peace river, or a wagon-road joining the one now being constructed from Tacla lake to Silver creek, would increase the mining activity in this region tenfold. Machinery could be brought to either of these points of entry by light-draught steamboats."

*Report of the Minister of Lands, British Columbia, 1913—Survey Branch, pp. D. 354-355.

A MINING ENGINEER OF THE FIFTEENTH CENTURY*

Being Some Comments on "De Re Metallica" of Georgius Agricola, 1555.

By F. W. Gray.

As a relief to the consideration of the everyday problems that confront the mining engineer in his dealings with men and materials, complicated as they are by the vexatious and kaleidoscopic social conditions that attend this present age, it may afford diversion, and possibly a little consolation, to dip into the pages of a mining engineer who did his earthly pennance some five centuries ago, and whose experiences seem to have been not unlike to those now being passed through by those among ourselves who have the temerity in this topsy-turvy time to follow the profession of the mining engineer.

George Bauer was born in Saxony in 1494, long before the beginning of European colonization in North America, and he was a young man of 26 when Cortes and his Spanish braves conquered Mexico, thereby laying the seeds for a great deal of trouble among the mining engineers of our time. Bauer's work, "De Re Metallica," was published towards the end of a well-filled life, and appeared in 1555, shortly after his death. For two centuries it retained its premier position as the authority on mining. The work was written in Latin, the name Agricola being the latinized form of "Bauer" or the German for farmer. From time to time down the centuries, translations have been made, of varying merit. but it has remained for an American, Mr. Herbert Clarke Hoover, and his wife, to give to the English-speaking public a worthy and accurate translation, for which Mr. Hoover and his wife have earned the gratitude of every mining engineer who loves his profession. The translation is elucidated by full and learned annotations by Mr. Hoover, and is illustrated by all the curious woodcuts of the original work, in which one may trace the crude progenitors of the elaborate machines used in modern mining.

As the translator remarks, the work has no practical value to-day, but is interesting by reason of its antiquity, and by the comparisons it suggests with present conditions.

Agricola is decidedly of the opinion that the miner should be skilled in many arts and sciences, and specifies among the accomplishments necessary to his education instruction in philosophy (that is, natural science or physics), medicine, astronomy, surveying, arithmetic or accounting, architecture, and the law. Agricola has nothing but contempt for the ignorant and incompetent miner, and even in his limited day, appreciates the immense range of subjects with which the fully qualified mining engineer must acquaint himself, should he wish to become a "master miner." How would Agricola regard the mountain of mining literature which now confronts us, and is ever being added to, when, as in these latter days, the whole gamut of human knowledge is laid under contribution in the service of the miner? He would be both brave and sanguine who to-day would attempt a description of the whole art of mining in one volume.

A great deal of space is taken up by our worthy predecessor in defending the art of mining and miners against those who object to it as being destructive to agriculture, as inciting the passions and cupidity of men, and as not being "honorable employment for respectable people." It seems that the uninitiated have been saying hard things about our profession for a long time.

The following observations do not seem entirely unfamiliar, and perhaps could Agricola have seen the latest specimens of flotation prospectuses he might have been enabled to further extend his catalogue of "some of the wicked and sinful methods by which they say men obtain riches from mining."

"When a prospect of obtaining metals shows itself in a mine, either the ruler or magistrate drives out the rightful owners of the mine from possession, or a shrewd and cunning neighbor perhaps brings a lawsuit against the old possessors in order to rob them of some part of their property, or the mine superintendent imposes on the mine owners such a heavy contribution on shares that if they cannot pay, or will not, they lose their rights of possession; while the superintendent, contrary to all that is right, seizes upon all that they have lost. Or finally the mine foreman may conceal the vein by plastering over with clay that part where the metal abounds, or by covering it with earth, stones, stakes or poles, in the hope that after several years the proprietors, thinking the mine exhausted, will abandon it, and the foreman can then excavate that remainder of the ore and keep it for himself. They even state that the scum of miners exist wholly by fraud, deceit and lying. For to speak of nothing else, but only of those deceits which are practised in buying and selling, it is said they advertise the veins with false and imaginary praises, so that they sell the shares in the mines for one-half more than they are worth, or on the contrary, they sometimes deduct from the estimate of them so that they can buy shares for a small price."

The promoter of Agricola's day must have been a modest gentleman if he inflated his stock by one-half merely. Recent modern examples of the gentle art of fleecing lambs show great improvement in this particular branch of deceit, and in Agricola's century the agile promoter must have been woefully handicapped, when compared with his modern brother, by the lack of the untruthful camera, and the wondrous lithographs that are so useful in extracting savings from the stocking-toe. The advice of Agricola to the would-be investor can hardly be excelled to-day. He suggests that the wise and prudent man before buying shares "goes at once to the mine that he may for himself examine the vein, and consider whether he will buy or sell." What would Agricola have thought to oil wells in California, or Alberta—to come nearer home—advertised by reams of glozing lies through the columns of a syndicated press with keen financial instincts?

There is no mention of coal in the work, except a casual reference to bitumen, and the only source of power at the disposal of the miner of Agricola's century was the work of men and animals, and the natural forces of wind and water. Manual labor, aided by crude, yet ingenious, applications of the lever, screw, geared wheels and treadmills, was the chief motive power. Use was made of horses and dogs, and there is one curious illustration showing a treadmill operated by goats.

Probably the most interesting feature of the work, and certainly the most entertaining feature, is the numerous and detailed woodcuts. In the matter of illustration, Agricola's treatise puts to shame many modern technical works on mining, for the drawings are clear,

*A paper to be read at the Annual Meeting of the Mining Society of Nova Scotia, April 15.

plain and even spirited, and are not without artistic merit. Although published so soon after the invention of printing, the woodcuts in the work are of greater technical and illustrative merit than in many text-books of the nineteenth century. The illustrations of machinery show the assembled machines, and the unassembled parts. These are not shown in plan and elevation as in our modern mechanical drawing, but the component parts of machinery are shown in true perspective in the foreground, and as if laid out for inspection on the ground.

It is difficult for us who call ourselves moderns to conceive of a mining industry which does not include either the use or the mining of coal, and it is wholesome for us to see how very much it was possible for our progenitors to achieve without this now universal source of power. In Agricola's illustrations we can trace the embryo of the modern turbine, the ventilating fan, the centrifugal pump and other evolutions of the revolving wheel, but he could have had no glimmering of the possibilities—which even to us are just opening up—of electrical power, its generation, transmission and application. Compare with the modern electric hoisting engine Agricola's quaint description of the methods of descending a mine shaft with which he was acquainted. The methods shown are four in number, as follows: By ladders, by sitting on a stick, by sitting on the dirt, and by steps cut in the rock. The method described "sitting on the dirt" reminds one of the joys of boyhood, and must have so reminded Agricola, because he says: "Further, when the shafts are much inclined, miners and other workmen sit in the dirt which surrounds their loins and slide down in the same way that boys do in the winter time when the water on some hillside has congealed with the cold, and to prevent themselves from falling, one arm is wound about a rope, the upper end of which is fastened to a beam at the mouth of the shaft, and the lower end to a stake fixed in the bottom of the shaft." We are not told how the miner who adopted this method ascended to daylight at the end of his shift, but presume he either climbed a ladder, or came up "sitting on a stick."

The work goes with great fullness into the problems of mine-pumping, and the illustrations show a remarkable variety of mechanical principles applied to this work. The translator points out that up to the beginning of the 18th century water formed the limiting factor in the depth of mines, and that to the attempts to overcome this difficulty we owe the invention of the steam engine by Newcomen, and remarks "it should be a matter of satisfaction to mining engineers that not only was the steam engine the handwork of their profession, but that another mining engineer, Stephenson, in his effort to further the advance of his calling, invented the locomotive."

Bearing in mind the period at which Agricola recorded his observations he shows a singular freedom from superstition, yet he apparently accepts the then general belief that demons or gnomes haunt recesses of the mine. He refers to "demons of ferocious aspect, which may be expelled and put to flight by prayer and fasting." The belief in "kobolds" or gnomes is peculiarly Teutonic, but as the translator remarks: "The German miners were not alone in such beliefs, for miners generally accepted them—even to-day the faith in "knockers" has not entirely disappeared from Cornwall. Neither the sea nor the forest lends itself to the substantiation of the supernatural as does the mine. The dead darkness, in which the "miners' lamps serve only to distort every shape, the uncanny noises of restless rocks whose support has been undermined, the approach of danger and death without warning, the sudden vanishing or discovery of good fortune, all yield a thousand corroborations to minds long steeped in ignorance, and prepared for the miraculous through religious teaching."

All who have had to do with mine and miners for any length of time can testify to the survival of such belief, to uncanny coincidences, and to some old wife's tale predicting disaster. An interesting volume could be compiled on miners' superstitions, such as their aversion to meeting a woman when going to work in the early morning, and the awesome tales of the "red dog" seen before an explosion. Happily, however, it is but the lingering remnants of such absurd beliefs that are met to-day.

Even to-day there are those who believe in the "dowsing rod" or the divining rod, and it says much for Agricola's good common sense that he considered the use of the forked hazel twig as an aid in the search for metals to be unworthy of the attention of a serious miner. After giving logical reasons for his disbelief, Agricola remarks: "Therefore a miner, since he ought to be a good and serious man, should not make use of an enchanted twig, because if he is prudent and skilled in the natural signs, he understands that a forked twig is of no use to him, for there are the natural indications of the veins which he can see for himself without the aid of twigs."

Our author is equally incredulous of the claims of the alchemists, who flourished exceedingly in his times, and sarcastically dismisses their pretensions by remarking that if they were true the alchemists "would by to-day have filled whole towns with gold and silver."

It is only recently that the newspapers told of the deception successfully practised on a well-known diamond mine owner by a gentleman who undertook to make diamonds from base materials, and although, as we see, the claims of the alchemist have been scouted by practical miners for five centuries the species still survives, and will probably continue to survive so long as mankind is credulous and greedy of gold.

The cult of scientific management, card indexes and efficiency, had not appeared in Agricola's generation, and although Agricola would probably have been puzzled to grasp the significance of cinematograph time and motion studies, he had a sound grasp of the "fundamentals" that are being re-discovered in our day and are being christened afresh. Witness the following shrewd remarks:

When anyone, in an endeavor to increase his fortune, meets the expenditure of a mine alone, it is of great importance that he should attend to his works, and personally superintend "everything that he has ordered to be done. For this reason, he should either have his dwelling at the mine where he may always be in sight of the workmen, or else he should live in the neighborhood, so that he may frequently inspect his mining works. Then he may send word by a messenger to the workmen that he is coming more frequently than he intends to come, whereby he so frightens the workmen that none of them perform their duties otherwise than diligently. . . . Indeed the owner should frequently remain for days and nights in the mine, which in truth is no habitation for the idle and luxurious. That mine is well conducted in which not only the foreman but the owner himself gives instruction as to what ought to be done."

We now say that "eternal vigilance is the price of safety"; we improve the mine supervision and call it the "safety first movement." Different times, different names, but after all human nature appears to have varied little in the course of ages.

In these days of "scheduled occupational diseases" and compensation acts, the mine manager has perforce to take cognizance of the diseases to which miners are liable, and we are all becoming more or less familiar with the pathology of the miner. Agricola seems to have been as discerning in this matter as in all others connected with his profession, and he mentions the tendency of the miner to rheumatism, to consumption, to infected wounds, and to accidents at work. He instances how these ailments and accidents can be guarded against, and is of the opinion "that we should always devote more care to maintaining our health, that we may freely perform our bodily functions, than to making profits."

Modern doctors state the miner is prone to neurasthenia. A prominent English physician attributes this characteristic to the dangerous nature of their work and the influence of heredity. "A miner's frame of mind on going to work is one of unconscious apprehension, and the effect of this mental condition from one year to another, and from one generation to another, has an important influence upon the etiology of neurasthenia in this class of men."

Compared with his modern representative the miner of Agricola's time had ample reason to be nervous, but we find it stated on the contrary "while the workmen are carrying out their tasks, the depths of the earth often resound with sweet singing, whereby they lighten a toil which is of the severest kind and full of the greatest dangers."

Notwithstanding the gloomy dictum of the physician just quoted it is stated by him that the British mortality figure from all causes of death was only 88 for coal miners, as compared with 100 for all occupied males. The social condition of the miner has been steadily improving in our time, and is still improving, though with greater rapidity than in the past, and we prefer to believe that the mental and bodily health of the miner were never so good in the history of the world as they are to-day.

It is not stated anywhere in the treatise that women were employed in mining, but several of the illustrations show that females worked at the lighter operations such as sorting ore and on the concentrating tables.

The basic principles of the art of surveying appear to have been well understood by Agricola's contemporaries, but as in the case of mechanical drafting, they do not appear to have apprehended the science of plotting and plan-making to scale. The work shows illustrations of triangulation, of the plumb-bob, plummet level and what is practically a plane-table. A compass is also shown very similar to a modern instrument, but it does not appear to have been used in recording angles, but merely to ascertain the geographical direction. The limitations under which the surveyor of Agricola's day labored may be gathered from the fact that all underground surveys were plotted on the "surveyor's field," *i.e.* were reproduced at full scale on a level piece of ground, and mine plans on a reduced scale were the development of a later time.

Our learned author wrote many other books during his lifetime, and seems to have contemplated some that have either been lost or were not published. He wrote regarding fossils, regarding the animals that live underground, and was the author of various works on grammar, medicine and theology. He also found time to write advocating war with Turkey, having evidently appreciated the disastrous effects on European civilization to be apprehended from Mussulman domination. Nevertheless, after a life of unremitting labor, his body was refused burial because of his religious beliefs, and in his native town no memorial exists of the great services he rendered to the mining profession. But Agricola's hatred of charlatanism and superstition, his appreciation of the many-sidedness of his honorable profession, and that for the learning thereof there is no royal road, no means of final attainment but labor itself; are worthy of perpetuation, and of emulation by mining engineers of our day. In Agricola's own words, the mine is no place for the idle or the luxurious.

THE INFLUENCE OF NICKEL ON SOME COPPER ALLOYS.

Summary of Paper, by Professor A. A. Read, M. Met., and R. H Greaves, M.Sc. Read at the Annual General Meeting of the Institute of Metals, held in London on March 18th, 1914.

The influence of varying percentages of nickel on some mechanical and physical properties of the copper-aluminum alloys, with 5 and 10 per cent. of aluminum respectively, has been investigated. Hot, rolling and forging tests showed that apart from increased hardness and the necessity of a higher rolling temperture, the behavior on hot rolling of alloys with up to 7½ per cent. of nickel was identical with that of the pure copper-aluminum alloys. Malleability and ductility are rapidly reduced by nickel in the 10 per cent. aluminum series, but with 5 per cent. of aluminum the presence of nickel increased the ductility as judged by the wire drawing tests.

The main features of the tensile, hardness and alternating stress tests considered in conjunction with the microstructure may be stated briefly as follows:

(1.) **Alloys with 10 per cent. of Aluminum.**—Nickel up to 10 per cent. in the chill castings gives increased maximum stress and yield point at the expense of elongation and reduction of area; 5 per cent. of nickel gives maximum hardness; 5 per cent. of nickel improves the annealed metal and diminishes the detrimental effect of annealing on the 10 per cent. aluminum alloy. This composition corresponds to the limit of the alpha plus beta structure, increase of nickel above 5 per cent. being accompanied by the separation of a blue constituent in place of beta. The effect of quenching on these alloys is similar to that on the 10 per cent. aluminum bronze, but becomes less marked as the nickel increases.

(2.) **Alloys with 5 per cent. of Aluminum.**—Both in the chill castings and annealed rods, nickel has little effect on the hardness, maximum stress and yield point until 5 per cent. is present. The ductility, however, is greatly increased by 1 per cent. of nickel. With less than 5 per cent. of nickel, the alloys consist of a homogeneous solid solution; with more than 5 per cent. a second constituent separates on slow cooling, causing in the annealed rods a rapid increase in hardness, maximum stress and yield point, with an accompanying diminution in elongation and reduction of area. The effect of quenching on the alloys with 5 per cent. of nickel and over is to retain the second constituent in solid solution and thus to increase the ductility, while the hardness, maximum stress and yield point diminish. The rate of cooling need not be very great for air-cooled rods gave results which approximate to those of the quenched.

The presence of nickel makes practically no difference to the specific gravity of these alloys; their melting points are raised, and conductivity for electricity greatly diminished. Corrosion by sea water is greatly reduced by the presence of nickel; there is no difference in behavior between the annealed and cold rolled metal. All the alloys with 5 and 10 per cent. of aluminum and varying nickel behaved better, both in fresh and sea water than either Muntz metal or naval brass.

TOUGH-OAKES GOLD MINE, KIRKLAND LAKE, ONTARIO

By the Editor.

Kirkland Lake is Ontario's newest important productive gold district. The lake from which the district took its name lies about four miles north-east of Swastika, a station on the Ontario Government Railway. Swastika is 60 miles north of Cobalt and 390 miles from Toronto. There is daily train service to Swastika and daily stage service from Swastika east to the Teck-Hughes and Tough-Oakes mines.

The Tough-Oakes is the most promising property in the district, and the one on which most work has been done. The five claims, comprising 185 acres, are located in Teck and Lebel townships, about five and one-half miles from Swastika.

Development work.—At the Tough-Oakes property a number of gold quartz veins have been discovered, and two of these, No. 2 and No. 3, are now being developed. The former has been opened up by a shaft now, March 30, 280 ft. deep and by short drifts at the 100 ft. and 200 ft. levels. A shaft is being sunk on the No. 3 vein and is, on March 30, 75 ft. deep. Both shafts are being deepened and the drifts on No. 2 vein are being extended. Only a few drills are in operation, but good progress is being made. The plant is not sufficient for extensive operations. A new compressor is now being installed, and arrangements have been made that will result in the company soon having plenty of electric power to drive all the machinery required at the mine.

SURFACE PLANT AT NO. 2 VEIN

Tough-Oakes mine, Kirkland Lake, Ont.

At present the development is being pushed as rapidly as the power supply will permit. There are three eight-hour shifts. Two plugger drills are used in shaft sinking. The drifting is done partly with hammer and partly with piston drills.

Areal Geology.—The accompanying sketch, made by Mr. R. E. Margenau, from the mine maps prepared by Mr. M. W. Hotchkin, shows the location of the veins and their surface relationships to the rocks enclosing them. Mr. Hotchkin in making his map had the use of studies concerning the geology of the area made by Mr. A. G. Burrows, of the Ontario Bureau of Mines. Mr. Burrows' geological map of the district was issued last summer. Mr. Hotchkin's map is similar, but more detailed. It covers a comparatively small area.

It will be noticed that the rocks nearest the veins are porphyry, conglomerate, greywacke and lamprophyre. Mr. Burrows considers that the conglomerate and greywacke is of Timiskaming age, while the porphyry and lamprophyre are later intrusives. The ore occurs in veins in the porphyry and in the sediments near the porphyry. No ore has been found in the lamprophyre.

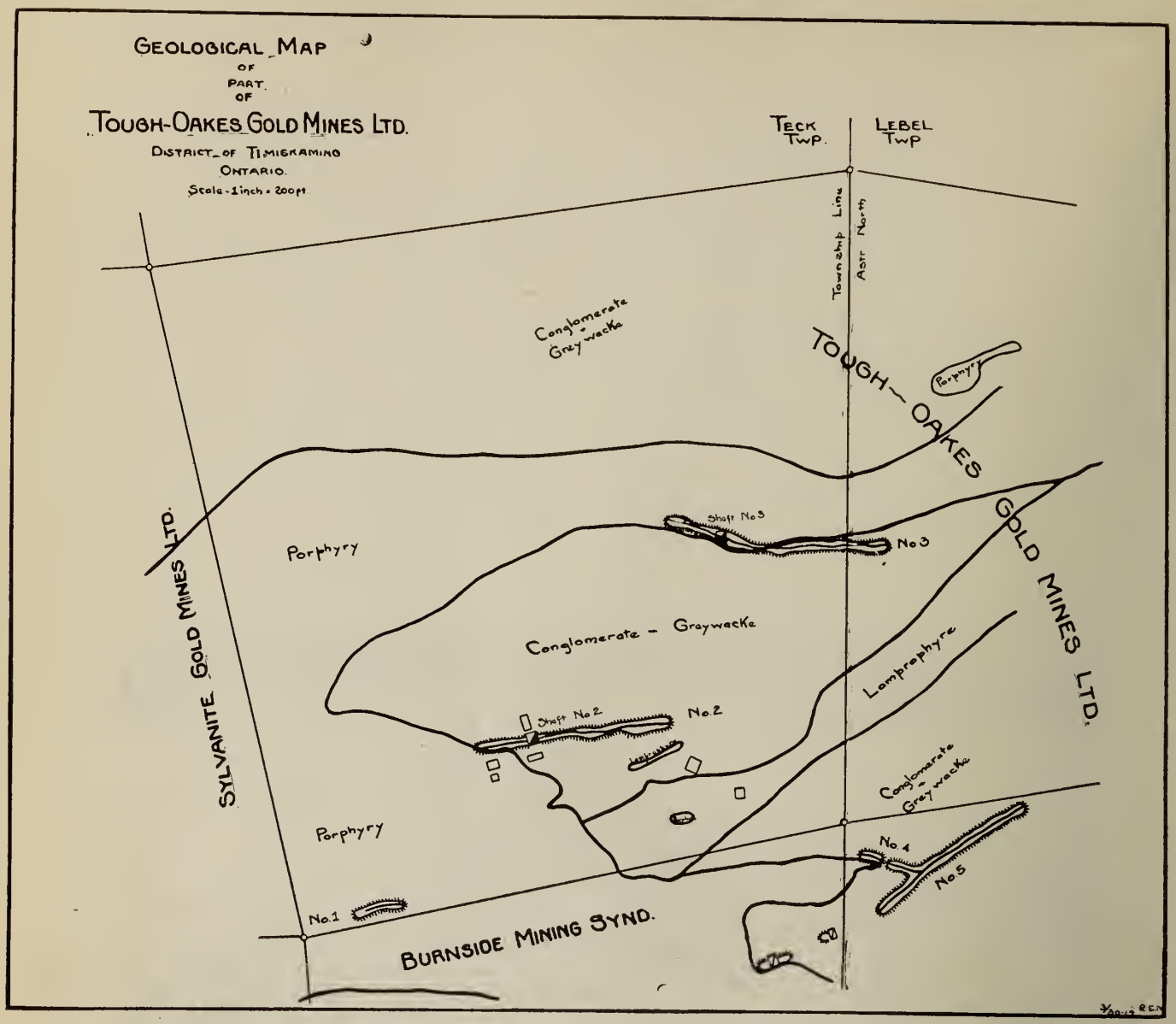
The Gold Deposits.—The surface exposure of No. 2 vein shows it to be in conglomerate near a mass of porphyry. The vein approaches the porphyry towards the west. The vein strikes east and dips south at about 60°. At the 100 ft. level the drift west encountered porphyry a few feet from the shaft. The igneous rock bulges down from the hanging wall for a few feet, and the drift passed through it in a few cuts. Continuing west along the vein porphyry was again encountered in the drift. The porphyry crosses diagonally across the drift, and the values were found to continue along the strike of the vein into the porphyry. Just at the contact the values are said to have been low; but very good ore is now being broken in the west drift, where the vein is entirely in porphyry.

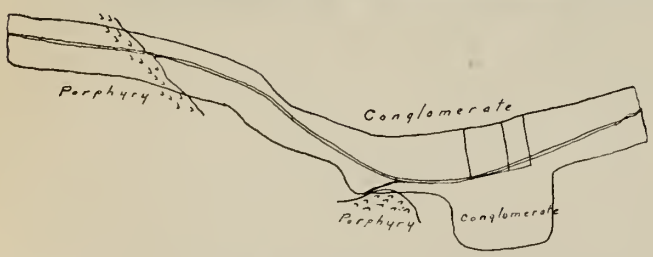
The east drift is in the sedimentary rocks entirely. So is the east drift at the 200 ft. level.

In following No. 2 vein downwards porphyry was encountered in the hanging wall. At the 200 ft. station the contact is well exposed and is clearly defined. The vein is for some distance in the conglomerate, near or almost on the contact. At a depth of 280 ft. the vein is entirely in porphyry.

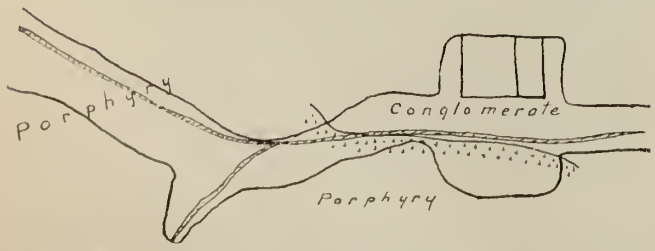
The west drift at the 200 ft. level is for some distance partly in conglomerate; but the face is now entirely in porphyry.

The gold bearing quartz occurs in rock that has been very much fractured. Fracturing took place both before and after the deposition of gold. That

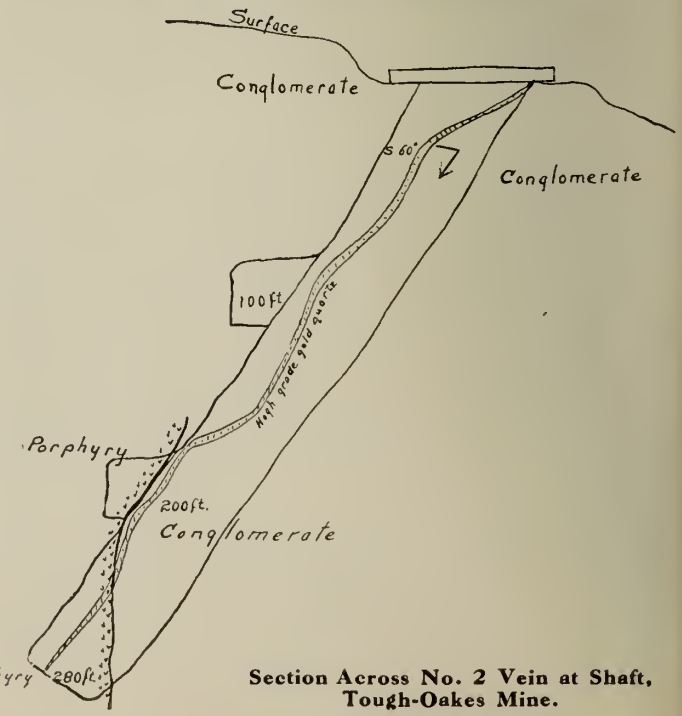




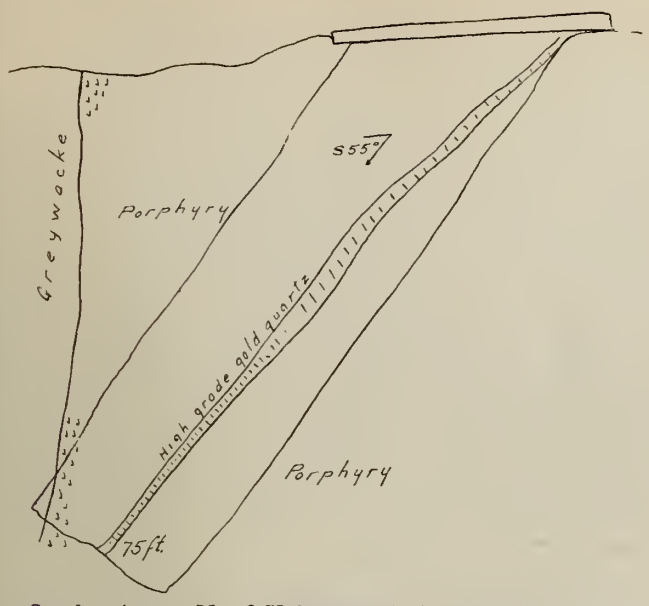
Sketch Showing Workings on 100 ft. level, No. 2 Vein, Tough-Oakes Mine



Sketch Showing Workings on 200 ft. Level, No. 2. Vein, Tough-Oakes Mine



Section Across No. 2 Vein at Shaft, Tough-Oakes Mine.



Section Across No. 3 Vein at Shaft, Tough-Oakes Mine

fracturing preceded deposition is quite evident from the fact that gold is frequently seen on fractured surfaces. That subsequent fracturing took place is evident from the numerous small faults in the veins and the presence of veins which cut across the ore. This fractured zone has evidently been impregnated with gold bearing solutions. In many places good assays are obtained in rock which contains no distinct quartz veins, but which is much fractured and has a thin deposit of minerals on the fractured surfaces.

No. 3 vein at surface is partly in porphyry and partly in greywacke. It strikes east and dips south at about 50°. A shaft was started in the porphyry and is, on March 30, 75 ft. deep. The last cut shows a little greywacke in the hanging wall. The ore broken in development work is partly high grade vein matter and partly lower grade wall rock. The vein is, like No. 2, only a few inches thick; but very rich.

The accompanying sketches illustrate the geological structure. These illustrations are merely sketches, not accurate drawings. They will, however, serve, I hope, to make more clear some structural features of the deposits. To Mr. M. W. Hotchkin, assistant manager for the company, I am indebted for most of the information from which the sketches were made, and in part for the sketches also.

The veins are not as regular as the sketches indicate. In places scarcely any distinct quartz vein is visible. In places the vein is several inches wide. In places there are two veins close together. No attempt has been made to show all these numerous irregularities in the illustrations.

At the contact west of the shaft, at the 100 ft. level, there are two distinct veins, a short distance apart. One of these continues fairly regularly along to the west, the fissuring seeming not to have been affected seriously by the nearness of the porphyry. The vein lying nearer the porphyry, however, turns suddenly to the contact and follows along the contact.

In the west drift, at the 200 ft. level, the most conspicuous vein is the one which turns towards the hanging wall. The main fractured zone seems, however, to be further in the footwall. High assays were obtained there and the drift continued in the fractured zone. The porphyry in the west face shows numerous thin black seams, which are rich in gold and in many places carry visible gold.

The veins do not cross the porphyry-conglomerate contact so abruptly as shown in the sketches. They follow along close to the contact for some distance, and it is not easy to point out the exact place at which the vein may be said to enter the porphyry.

The Ore.—The gold occurs in very narrow quartz veins and in the fractured rock enclosing the veins. The vein material is high grade and much of this ore has been sorted out and shipped without treatment at the property. The remainder of the ore broken in development work is of good grade and much of it has been crushed in a 5 stamp mill on the property.

Tough-Oakes Office, Laboratory, Stores and Camp Buildings

Native gold and tellurides both occur in the ore. There are at least two tellurides, one rich in gold and one containing little or none. While the gold tellurides are of little importance in comparison with the native gold, it has been found that tellurides are generally present in the ore, and can generally be detected in the rich ore.

The native gold occurs in many places in particles large enough to be readily detected by the naked eye. Very frequently the particles are associated and were apparently deposited on a black soft substance, which contains molybdenite. This black substance occurs very commonly as a coating on the fractured surfaces of the quartz and country rock.

Silver probably occurs both in the native gold and in the tellurides. Analyses are not yet available, but the recovery on the amalgamating plates in the mill indicates the presence of silver in the native metal.

During 1912 two shipments and during 1913 three

Shaft on No. 3. Vein, Tough-Oakes Mine

No. 2 Vein Shaft House and 5 Stamp Mill, Tough-Oakes Mine

Tough-Oakes Power House

Logging Operations on Claims Adjoining the Tough-Oakes

shipments of vein material were made. The 101.049 tons contained in these five shipments contained 2,183.756 oz. of gold and 4,025.58 oz. of silver. The gross value was $46,221.20, and the net value $44,005.31.

The 5 stamp mill was started in the early summer of 1913, and during the remainder of the year treated 1,975 tons of ore, which yielded 1,272.446 oz. of gold and 198.28 oz. of silver. The gross value was $26.348.87. Only about 50 per cent. of the gold was recovered. The tailings are ponded for future treatment.

The following tables show the character of the several shipments made to Dec. 31, 1913:

These figures show that a portion of the high grade ore broken in development work yielded over $400 per ton, while the low grade yielded about $13 per ton and contained about $25 per ton, the balance not yet recovered. The best method of recovering the gold in the tailings is still to be determined.

According to Mr. Charles O'Connell's report of January 24 the average value of the milling ore then exposed was $23.30 per ton.

The Tough-Oakes promises to be when equipped a very profitable gold mine. The development work so far has been very encouraging and already there has been partially blocked out ore of a very considerable value. The openings are not extensive, but according to the report of the manager there was about three-quarters of a million dollars in sight at the beginning of the year. Mr. H. H. Johnson, who examined the mine last December, estimated the reserves at about $1,100,000. Since that time there has been considerable addition to the reserves. None of the estimated ore is blocked out on four sides.

Recently the control of the property was taken up by Kirkland Lake Proprietary, Ltd., and later the Tough-Oakes Gold Mines, Ltd., was formed to acquire it from Kirkland Lake Proprietary. The Tough-Oakes Gold Mines, Ltd., is capitalized at £500,000 in £1 shares.

Mr. Chas. O'Connell is manager of the mine, Mr. M. W. Hotchkin assistant manager, H. Herbert, accountant, R. E. Margenau engineer and Fred Jost mill superintendent.

Ore Shipments During Years of 1912 and 1913, Tough-Oakes Gold Mines, Ltd.

Shipment.	Date.	Net dry tons.	Oz. per ton Silver.	Oz. per ton Gold.	Gross Value.	Net Value.
A	Sept. 8. 1912	1.892	....	17.451	$660.37	$660.37
B	Dec. 21. 1912	19.905	23.400	22.509	9,235.60	8,799.00
C	Mar. 19, 1913	20.527	33.665	19.688	8,492.23	8,120.00
D	June 5. 1913	30.438	37.900	23.040	13,147.10	12,343.50
E	Oct. 31. 1913	28.287	67.500	24.075	14,685.90	14,081.91
		101.049			$46,221.20	$44,005.31

Bullion Won From 1,975 Tons Milled in Year of 1913, Tough-Oakes Gold Mines, Ltd.

Bullion.	Date.	Oz. Silver.	Value Silver.	Oz. Gold.	Value Gold.	Gross Value.
Bar No. 1.....	....	....	....	....	....	....
Bar No. 2.....June,	1913	50.83	$29.54	296.175	$6,122.48	$6,152.02
Bar. No. 3.....Aug.,	1913	28.10	16.50	207.250	4,212.75	4,229.25
Bar No. 4A.....Sept.,	1913	43.86	26.53	280.321	5,794.75	5,821.28
Bar. No. 5A.....Nov.,	1913	37.84	22.42	233.662	4,830.23	4,852.65
Bar No. 6A.....Dec.,	1913	37.60	21.57	255.038	5,272.10	5,293.67
		198.23	$116.56	1,272.446	$26,232.31	$26,348.87

VANCOUVER ISLAND RIOT CASES

In British Columbia the prosecutions for unlawful assembly, rioting, and other breaches of the law in connection with the strike of coal mine employes on Vancouver Island have been brought to a conclusion. In view of the fact that there still remained more than fifty of the accused to be tried by the Supreme Court, that large expense was being incurred, that serious inconvenience and loss to those of the public who had been summoned as jurymen as well as to the accused themselves and their families where married men were concerned, and that there was a widespread feeling that the law had been sufficiently vindicated by the numerous convictions obtained, and it becoming known that the Provincial Government was disposed to be lenient, an arrangement was made between the Attorney-General, representing the Government, and counsel for the men still awaiting trial by which the remaining fifty-two cases were to be immediately disposed of. Under this arrangement charges which were not very serious were withdrawn in twenty cases, while in the cases of practically all the others a plea of guilty of unlawful assembly was to be entered. A few of the accused declined at first to consent to pleading guilty, but eventually they joined the large majority, and so the longest criminal assize in the history of British Columbia was brought to an end, the closing act having been the sentencing, on March 23, of those convicted during the assize. One man was sentenced to four years in the penitentiary, eight to one year each in a provincial jail, one to six months and another to a like term, but to be less the four months he had already spent in jail. Four others were sentenced to the time they had already served while awaiting sentence, and the remainder, with the exception of two postponed cases, were allowed their freedom on suspended sentence. These were not all the convictions, for nearly five months previously about 40 men of those who had chosen speedy trial in a lower court were sentenced to various terms of imprisonment.

The man sentenced to four years' imprisonment, Joe Angelo, was at the time of his trial, early in January, thus described in a Vancouver daily newspaper: "Joe Angelo is a well-appearing man. Swarthy of countenance, he betrays his Sicilian home in his broad shoulders and rounded head. His countenance is open and rather pleasing. A broad intelligent forehead and finely chiseled Grecian nose are appropriately matched by a well-modelled mouth beneath a nut brown mustache, and a firm strong chin. His eyes seem ever changing in expression. He is a middle-aged man, his raven black hair being tinged with grey. He has been identified with the United Mine Workers of America for years, and his ability as an organizer was responsible for his selection by the union officials at the headquarters in Indiana when the officers of District No. 28 (Vancouver island) asked for a man to instruct the foreigners in the principles of unionism. His home is in Bridgeport, Ohio, where his wife and four small children reside. He arrived in Nanaimo shortly before the strike and at once commenced his work among the 600 Italians who work in the Vancouver Island collieries. Bail was refused Angelo after his arrest, and he has been held in jail ever since he was apprehended in August last. When ordered to stand up for pronouncement of sentence and asked by the judge what he had to say, Angelo replied: "I am not guilty of the charges, and I have a wife and four children." He was followed by his counsel who besought clemency on the grounds that he was an alien and a married man. The judge addressed the prisoner thus: "Yours is a very grave offence, and there are very few extenuating circumstances. You are a member of a powerful organization, and no doubt your family will be taken care of. The fact that you are an alien is hardly a circumstance in your favor. Your appearance synchronized with the outbreak. Your influence led these other men to do what they have been found guilty of. Whether you have been a tool or not of others, I have my own views as to that." The judge then commented upon the fact that a great deal of damage had resulted from the offences that Angelo had been accused of. He sentenced him to four years in the penitentiary.

Going back to the time of Angelo's trial, the following is an excerpt from a report of the proceedings: "Angelo, it is charged by the Crown, is one of the men who planned the riots which occurred at Extension colliery when a crowd of 600 or 700 men invaded the peaceful little mining camp in the hills and after driving the non-union workers and their families to the woods under a hail of bullets, applied the brand to their homes, and in the dusk of the autumn evening looted and pillaged by the light of the burning houses. Mrs. Charlotte Scavardi was the chief witness for the prosecution. In a clear, ringing voice this young woman told the story of how she and her babes had been driven over the hill to the fringe of the forest, where they remained all night, to return late the next day under military escort to view the smoking remains of her home. Everything that she and her husband owned—the savings of years of toil in the mines—had been, she testified, wiped out, and now they found themselves almost destitute."

The recent attitude of the Hon. the Attorney-General for British Columbia in regard to the men under arrest when the proposal was made that proceedings in the Courts be stayed, is indicated in the following statement made by him: "I want to deal leniently with these men. The Government does not wish to prosecute unduly, and I may say that we have always intended to take this stand when the right time came. Our attitude has been that when the law was vindicated we would deal leniently with the accused men. But we believed it was necessary to show the public of this Province that while men could strike all they liked they could not be permitted to take the law into their own hands. The law has now been vindicated, I believe." The Attorney-General has agreed to hear representations from counsel for the miners and their union officials looking to the selection of the less serious cases first, with a view to recommendation to the Minister of Justice at Ottawa for the pardon or parole or otherwise lessening the punishment of the men who have been sentenced to imprisonment. With a similar end in view, the Attorney-General will also carefully consider the cases of the men who were sentenced about the end of October in the Speedy Trials Court. Incidentally it may be stated that it is quite probable some of these men would have ere now been given their freedom but for the threats and other ill-advised proceedings of some of those who professed themselves to be friends of the prisoners. The violent language used at public meetings of Socialists, and a so-called Miners' Liberation League, and even of members of the British Columbia Federation of Labor, instead of inducing clemency, probably deterred the Department of Justice from taking action in the direction of releasing some of those in prison. An instance of the folly of some of the agitators was that of Vice-president A. Watchman, of the British Columbia Federation of Labor, who threatened the Premier of the Province, when demanding the liberation of the miners then in jail, that

if this were not granted there would be a two-day's strike of all labor in the Province at the end of January. The Premier's reply was to the effect that while a general strike, which might involve industrial ruin in the Province, would be calamitous, no threat of that kind would deter the Provincial Government, nor the Minister of Justice for Canada, from executing the laws of the land. "If the power to pardon," said he, "is to be influenced by threats of industrial strikes, a precedent would be established that could only mean disaster to the civil liberties of the people of the Province."

Another noteworthy admonition is that Mr. Justice Morrison who, speaking to the men when giving some of them their freedom under suspended sentence, said: "I hope you realize that the idea is not to punish but to prevent a recurrence of the things that you are charged with. The brainy men of labor know that you can not make progress by burning houses and assaulting and insulting others. In allowing you out of prison on suspended sentence I am trusting you, but the arm of the law is long, and if you violate our confidence you will be brought back here again, and you know that you can not then expect any consideration. I will accept your undertaking that you will not participate in any further trouble of this sort." To all of the convicted men he said: "Now I wish you to take heed of what I tell you, and it is that you can not successfully put a restraint upon freedom in this country—neither upon freedom of labor, freedom of lawful action, nor upon freedom of capital. As law-abiding citizens, it is your privilege, and I hope you will deem it your duty, to further that freedom. There is no monopoly in this country. There is no class distinction recognized by law, and therefore no class legislation. No one class of men have by law an advantage for their own special benefit. Do not be misled into believing anything to the contrary. Unfortunately most of you are made the victims of demagogues or other factious orators. You have full liberty to combine to secure an increase in wages and to secure to yourselves every necessary safeguard in your dangerous and arduous labors. Nor can it be denied that the unions have a right to enforce among their members observance of their proper rules, regulations and laws. But they have not the additional right to interfere with others as to whether they shall or shall not work just as those who choose to strike may direct. There is nothing that our laws guard more strongly than personal freedom. There is nothing each one of you would resent more quickly than any restraint of your freedom by dictation as to how you should use your trade, your intellect, your earnings—and all these privileges are as much under the protection of the law of the land as is the protection of your body. The interest of the public after all is greater than that of union or party, and the manner in which a workman shall dispose of his labor is a matter of public interest. If, therefore, a workman is interfered with by intimidation, picketing, molestation, unlawful assemblies, or riots, and is so influenced as to how he shall utilize his industry or his talent there is committed a breach of the law constituting a criminal offence. That is the law of the land, declared and enacted, not by the judges, but by you—at least, by those of you who enjoy the Canadian franchise—through your representatives in Parliament assembled. These are your laws, and they shall stand, and must be invoked in proper cases while they do stand, and for your protection as well. They shall and must be obeyed so long as constituted authority shall hold out against the anarchists, as it is abundantly able to do.

"You have been found guilty by what I consider sympathetic juries. There is not a thinker of any distinction on the subject of labor to-day who is not against the adoption of the methods charged against you and of which you have been found guilty. Had the Attorney-General, who is a sworn servant of the people, with all the information placed before him, failed to put the machinery of the law in motion for the protection of the public and to prevent a recurrence of such acts of lawlessness, he would have been unworthy of the great trust reposed in him by the people. For every act and for every cent of public money expended in those prosecutions he is accountable to the public—to you and to me, and I want you to know that his ability and the revenues of the country are at your disposal if and when circumstances require them, either for the protection of your property or your freedom as well as for your defence on charges of the alleged invasion of the right of others. No man need go undefended in this country for the want of funds if he is bona fide unable to defray the expenses of his defence in a criminal trial.

"In conclusion, I consider it my duty to burn this fact into your minds—you cannot break the laws of this country with impunity. On the very lowest ground it is, in the first place, poor policy. You can not afford it. On much higher grounds, you are violating your conscience and you know it."

THE MINERAL PRODUCTION OF QUEBEC IN 1913

A preliminary report by Theo. C. Denis, published by the Department of Mines, Quebec.

The value of the products of the Mineral Industry of the Province of Quebec in 1913 totalled $12,918,109. These figures are compiled from returns received by the Quebec Mines Branch direct from the producers. Although they are liable to change slightly, owing to additional dilatory returns, they are sufficiently near to give an accurate idea of the condition of our mining industry.

This preliminary statement will be superseded in a few weeks' time by the more complete annual report, which will give the corrected figures as finally compiled.

The mineral production of the Province of Quebec for 1913 is the highest yet recorded. It is gratifying to note that, for the last ten years, we have an unbroken series of increases of each year over the preceding one.

Asbestos.—Returns received from eight producers show an appreciable increase in the shipments of asbestos from the producing centres of Thetford, Black Lake and Danville.

None of the East Broughton properties were reopened during the year; at Robertson, only one mine was in operation. The fibre of the East Broughton rock is short and its market value is low, but, on the other hand, the percentage of fibre recovered from the rock is high. The quality of the rock at Robertson stands intermediate between that of Thetford and of East Broughton.

There has been a marked improvement in the asbestos market, and although the conditions are not yet ideal, they are more satisfactory than they have been for several years. The working margin of profits in the asbestos industry is narrow. Taking last year's figures, we see that the production, i. e., the asbestos extracted from the rock, totalled to a value of $3,578,-

007. This is, of course, allowing the same prices for the stock on hand as for the shipments sold. This value of asbestos was extracted from 2,527,410 tons of rock. It is true that 25 per cent. of this rock goes direct to the dump and is not treated in the mill, but nevertheless, all of it has to be quarried and hoisted to the surface from depths reaching over 200 ft. Therefore, at that rate, each ton of rock yielded $1.42 of asbestos. In 1912, this figure was $1.38, and in 1911 it was $1.53.

Copper and Sulphur Ore.—Except for the very appreciable increase in the shipments of copper and sulphur ore, there are no new developments in this industry. The value of the copper and sulphur contents of these ores amounted to $866,774 in 1913. This is an increase of $234,811 as compared with 1912.

Iron.—The iron ore and iron smelting industry has been dormant in the Province for over two years. We have no production recorded since 1911, and the prospect for a resumption of activity is not of the brightest. The Canada Iron Corporation, which operated charcoal furnaces at Radnor and at Drummondville to treat the local bog iron ores, has placed its affairs in the hands of a receiver, pending a reorganization. The abolition of the Government bounties on iron and steel is said to have been one of the main causes of this state of affairs.

The 4,981 tons of titaniferous iron ore produced came from St. Urbain and from Ivry. It is used as an ore of titanium, of which element is contains from 18 to 30 per cent.

Graphite.—The results in the graphite industry have been very disappointing. The mills of the Dominion Graphite Co., the largest producers in 1912, did not re-open. Most of the other graphite plants report greatly reduced operations, with the exception of the Quebec Graphite Co. at Buckingham, which worked actively throughout the year, but mostly on experimental work.

Kaolin.—Although the production of china clay is yet very small, the outlook for the future is promising. The Canadian China Clay Company, who are working a deposit in Amherst township, Labelle county, have put in an experimental washing plant. This will be considerably enlarged, with some modifications, during 1914. The whole of the output of kaolin is sold to paper manufacturers, who use it as a filler.

Structural Materials.—Notwithstanding the general trade depression which prevailed during the year, it is gratifying to see that the production of structural materials more than held its own as compared with 1912. The figures for cement, limestone, granite and brick show increases. This indicates that, despite adverse conditions, the general development of the Province of Quebec was not in any way retarded, for the production of structural materials is a very good criterion of such progress.

Legislation.—During the session of the Quebec Legislature which has just closed, an amendment to the Quebec Mining Law was passed, reducing the price of mining concessions, from $20 to $10 an acre (according to distance from railway), to a uniform price of $5 an acre.

Labor and Accidents—In 1913, according to returns received, 8,996 men found employment in the mines, quarries, clay pits and ore mills in the Province of Quebec.

The total wages paid amounted to $5,179,395. A certain proportion of these men were employed for part of the year only, but the majority worked 300 days.

We have to record 15 fatal accidents; of these, ten occurred in the asbestos mines, four in quarries, and one in a copper mine.

HEDLEY GOLD MINING CO.

The annual report for the year 1913 of the Hedley Gold Mining Co., operating the Nickel Plate group of mines and 40-stamp mill in Camp Hedley, British Columbia, says in part:

Report of the President, I. L. Merrill.

February 20, 1914.

During the past year everything in general, at mine and mill, has gone fairly well.

The Dickson Incline has reached a depth of 700 ft., at which point we expected to drift into the ore body drilled into in 1912 by two drill holes, both showing an average of $20 ore, but a recent test hole put down from the bottom of No. 5 Incline only showed $7 ore. This may be a poor spot, but it leaves a chance to doubt this block of ore being of as good a grade as we estimated it in our last annual report.

We opened a large ore body with four drill holes to the northeast of No. 5 Incline, but of only an $8 to $9 grade.

These are the reasons for our report now showing reserves to be of lower grade than heretofore. However, we still hope actual drifting in these orebodies will prove them of a higher grade than the present work would indicate.

We are installing a new and larger water-power plant on Similkameen river, which will allow more economical work by the end of 1914.

For detailed information I submit the reports of superintendent and treasurer.

Report of the General Superintendent, G. P. Jones.

Hedley, B.C., February 10, 1914.

In the year 1913 the stamp-mill treated 70,796 tons of ore of an average assay value of $12.03 per ton. Total assay value, $852,261.26.

Extraction by concentration	$656,540.86
Extraction by cyanidation.	145.789.54
Total.	$802.330.40 or 94 per cent.

The ore mined during the year was taken from practically all the stopes and the value shown was the average run of the mine.

The reserve of 10,000 tons of broken ore in the stopes has been maintained.

The quantity milled this year was 341 tons greater than in 1912, and 12,891 tons greater than in 1911. The average value for the year was $12.03 per ton; for 1912 it was $11.19; for 1911, $11.99.

The power plant has been taxed to its limit to keep the mill running and supplied with ore, consequently the development work done was but little more than in 1912. A new incline shaft, the Dickson Incline, has been sunk, on a 30 deg. slope, to a depth of 700 ft., and two stations cut. This Incline is 8 x 16 ft. in the clear, double-tracked, and in good shape to pass ore as soon as connections shall be made. The inclination is greater than the dip of the lime silicate in which the ore shoot lies, so it passed through into an andesite sheet, but should at 900 ft. enter the lowest ore body which we discovered by diamond drilling. The ore to the west of the 600 ft. level was indicated by a drill

hole, the core of which returned high value. Another hole has lately been drilled to check, but the core did not average more than $7 per ton. Owing to this last hole cutting the formation at a different angle to the first hole, it may not have shown the correct value of the ore, so we have decided to drift across from the 600 ft. level and ascertain why these cores do not check.

The ground to the northeast of the No. 5 Incline and the Dickson Incline has been tested by horizontal drill holes from the No. 5 Incline, which indicate a very promising section of the company's property. One hole was drilled from each level of the No. 5 Incline, all of which cut ore, but the two lowest were the best, assaying $8.50 per ton.

Little development has been done on the other properties. The Sunnyside No. 4 Incline is in very promising country, well worthy of considerable prospecting, as also are other sections of the company's property. Before these can be satisfactorily drilled or prospected by shaft, drift or crosscut, it is necessary that we have more power.

The directors have given instructions to proceed with the construction of a hydro-electric power plant on Similkameen river, which will generate cheaper power for the present requirements, and surplus enough for development and an enlarged mill. The power plant as designed will have a maximum capacity of 1800 h.p. and by displacing the steam auxiliary should repay for its cost within four years. With sufficient cheap power the present mill equipment can be made to treat a greater tonnage, and the gain will be apparent all around.

We estimate the reserve tonnage of ore that can be mined and milled at a profit to be equal to our last year's estimate of 413,000 tons; but, owing to the new orebodies to the north being of lower grade than usual in this mine, and the failure to check the value in the drill hole to the west of the 600 ft. level, we would not estimate the value of the present reserves at more than $10 per ton. We, however, hope to make similar earnings per ton through cheaper power and possibly a slight increase in the tonnage. There is also a chance that drifting and stoping, while it may not show the ore to be of as high value as that shown in the hole to the west, may be equal to the average run of the mine, which has been about $12 per ton.

During the year about 85 per cent. of the ties of the 10,000 ft. of incline tramway have been renewed; a new hoist installed at the tipple station as well as new machinery at the ore bin station. This, together with the new machinery already installed at the central station, puts the tram in first-class shape. At the mine a blacksmith shop, general store, warehouse, oilhouse, powderhouse, etc., have all been built along the track to the No. 4 tunnel, and all mine buildings have been painted and renovated. There has also been added to the powerhouse a new boiler room, all of which, together with development work, renewals, etc., have been charged to operating.

Development work for the year consisted of sinking incline shaft 700 ft. and diamond drilling 935 ft.

I am glad to say that since writing the foregoing report we have drilled another hole to the west of the 600 ft. level, which passed through 32 ft. of good ore, thus checking up with the drill holes of 1912.

Report of the Treasurer, C. D. Fraser.

The net profits for the year were $405,254.89.

The dividends for the year aggregated $360,000.00 or 30 per cent. upon the issued capital stock.

The undivided profits, after all dividends, were $272,096.23 on January 1, 1914.

The directors authorized the construction of an all-the-year-round water-power plant at a cost of not over $200,000. Work was begun in November and $13,028.57 expended on this account by December 31. This amount has been charged to capital account. All other expenditures, including cost of Dickson Incline, new buildings, etc., were charged to operating expenses.

Statement of Operations and Earnings for 1913.

	Tons. Milled.	Assay. Value.	Recovery at Mill.	Expenditure.	Profits.
January ...	6,002	$14.12	$79,382.87	$37,158.44	$42,224.43
February ..	5,620	14.58	76,441.94	38,245.45	38,196.49
March	5,507	14.50	74,140.53	33,269.08	40,871.45
April	6,044	12.50	71,611.40	33,252.64	38,358.76
May	6,007	13.28	75,906.40	29,728.08	46,178.32
June	6,087	10.89	61,611.38	27,793.90	38,817.48
July	5,905	12.10	65,763.50	33,619.36	32,144.14
August	5,892	9.53	52,889.78	28,782.95	24,106.83
September ..	5,430	11.74	60,246.05	33,866.15	26,379.90
October	5,830	10.39	57,344.24	33,631.50	23,712.74
November ..	6,403	10.27	61,992.31	33,933.85	28,058.46
December ..	6,069	10.93	65,000.00	33,794.11	31,205.89
Totals 70,796		‡$12.03	$802,330.40	$397,075.51	*$405,254.89

‡Average.

*Including $7,402.23 interest earned on funds of this company during 1913.

CROW'S NEST PASS COAL CO.

At the annual meeting of shareholders in the Crow's Nest Pass Coal Co., held in Toronto, the report presented showed a balance of $470,456 as the net profit on the year's operations, which was a smaller amount than for the previous year. The output of coal at the company's mines in Crowsnest district, British Columbia, in 1913 was 1,166,378 tons, which was 102,000 tons more than in 1912; the quantity of coke made was 253,541 tons, or 8,212 tons more than in 1912. The year's expenditure on development and improvements was $178,000. Liabilities to bank were reduced $331,000. Incidentally, the president mentioned that since the close of the year there had been a further reduction of these liabilities by $50,000. The balance at credit of Profit and Loss brought forward from 1912 was $419,423; added to this was the above-stated net profit for 1913 and an amount of $26,773 at credit of subsidiary companies that had been transferred, these together making a total of $916,652 to be carried forward to 1914 as amount at credit of Profit and Loss. Some shareholders called attention to the fact that during five years only two dividends had been paid, and those of only one per cent. each, and they asked that a dividend disbursement be made, but all that the president would do was to promise consideration of their request.

ALBERTA OIL.

A press despatch from London, England, dated March 20, follows: At a statutory meeting of the British Alberta Oil Company, held at Birmingham yesterday, Mr. John Lee, chairman, announced that the company had contracted for drilling two wells in the Alberta oilfields, located in accordance with Mr. Cunningham Craig's instructions. Drilling, it was stated, would be begun early in April. Mr. Craig, who attended the meeting, will leave shortly for Alberta, with an assistant, to complete a survey on 10,000 acres controlled by the company, which considers it the most promising area yet taken up.

THE ELECTRICAL DRIVING OF WINDING ENGINES AND ROLLING MILLS

By C. Antony Ablett, A.M.Inst.C.E., and H. M. Lyons, A.M.I.E.E.

(Continued from last issue.)

The third method by which the connections of the motor are reversed, so that it is exerting its torque against the rotation, is extremely wasteful, because the motor takes power from the line in proportion to the turning moment which it is exerting, as well as the power which is given out by the winder, corresponding to the work done by the loads in descending.

As an example of this attention may be called to the lowering diagram, with reverse current, shown in Fig. 28. The amount of energy given up by the lowering of the load is 20,900 horse power seconds. The amount of energy taken by the motor from the supply is 42,900 horse power seconds. Therefore, in order to exert the braking effect on the winder, and to absorb the power

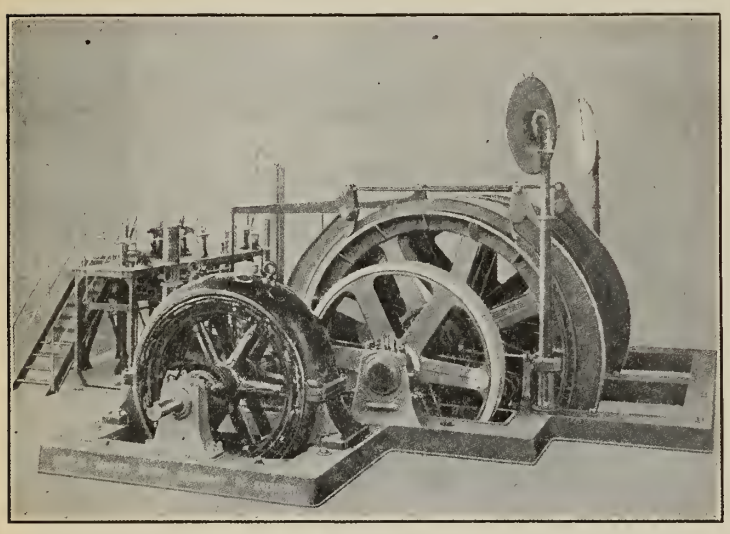


Fig. 30.—Three-phase cylindrical drum winder at H. Eckstein & Co.'s Bantjes Consolidated Mines, Johannesburg. Transvaal. This is probably the biggest three-phase gear driven winder in existence. Depth, 4,000 ft., on a 35 deg. slope. Nett load, 4½ tons. Maximum winding speed, 3,000 ft. per minute. Motor, 2,900 horse-power, at 375 r.p.m.

given up in lowering the load, which amounts to 20,900 horse power seconds, the starter has to dissipate 63,800 horse power seconds.

It will easily be seen, therefore, that when a load is lowered in this manner, the amount of energy which the starter has to dissipate is very large, and in order to enable lowering to be carried out in this way it would, in many cases, be necessary to employ a much larger starter than is required for controlling the winding engine when hoisting.

This method of lowering is the easiest to control, and, for this reason, although it is very wasteful, it is generally adopted for large three-phase winders.

Emergency Gear.—A three-phase winding engine is provided with a mechanical brake, which is brought into action by means of a weight attached to a lever, but the brake is normally held away from the brake drum by air pressure. If this air pressure fails, then the weight brings the brake on to the brake drum and stops the winder. As the speed of a three-phase winder for a given position of the control level depends on the load which is being hoisted, it is not possible to provide cams on the depth indicator in order to slow down the cage before it reaches the bank. The proper slowing down of the cage depends on the skill of the driver, but an overwind device is fitted both in the shaft and on the depth indicator, and in case the cage overruns the bank cuts off the power from the motor and applies the brake by means of the emergency gear.

An emergency lever is provided on the driver's platform by which he can cut off the power and apply the brake, stopping the winder immediately in case of necessity. In case the power supply fails the brake is at once applied through the emergency gear.

Hoisting Men.—With the three-phase winder the speed for winding men cannot be limited automatically,

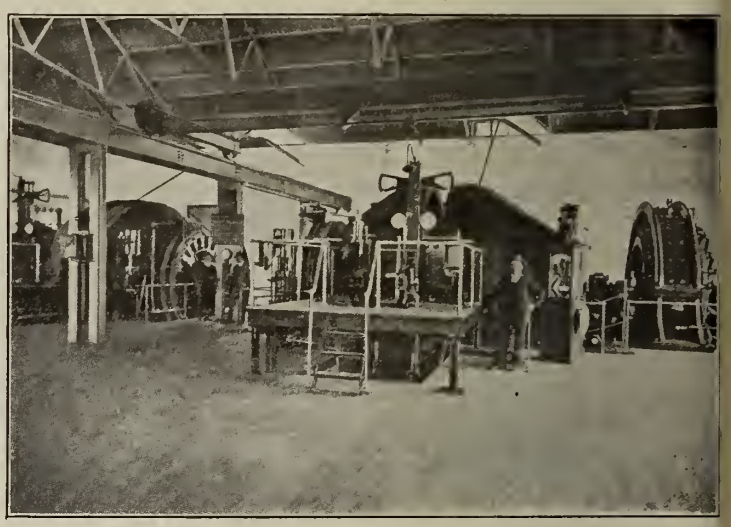


Fig. 33.—Ward Leonard conical drum winder at the General Mining & Finance Corporation Rand Collieries, Transvaal. Depth of shaft, 3,165 ft. Nett load per wind, 5½ tons. Maximum winding speed, 3,300 ft. per minute. Motor, 2,450 horse-power.

as in the case of a Ward Leonard winder, and the speed depends entirely on the skill of the driver.

Choice of Drum for Steam or Electrical Drive.

The conditions governing the selection of the type of drum differ very considerably, according to whether the winder is to be driven electrically or by a steam engine, and it is, therefore, very desirable to discuss this question in a paper on electrical driving.

It is characteristic of the steam engine that its overload capacity is not very great and that the turning moment varies according to the position of the cranks. For a two cylinder engine with cranks at right angles, such as is usually used for a steam winder, the minimum turning moment is .785 of the mean turning moment, and the maximum turning moment is 1.112.

The engine naturally must be able to start the hoist with the cranks in any position, so that the minimum turning moment must be at least sufficient to overcome the static load and friction.

An electric motor, on the contrary, has a very large overload capacity in proportion to the mean power which it will give, and, consequently, the motor for winding

engines is usually selected with reference to the equivalent continuous load, and it is very rarely indeed that the starting moment or acceleration peak needs to be considered.

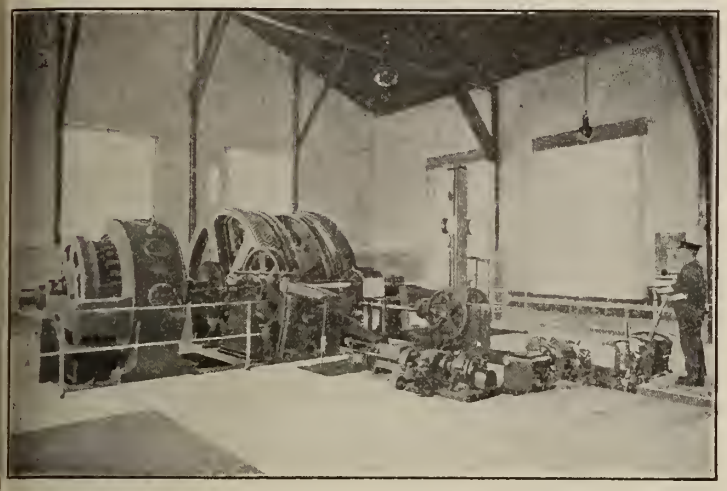


Fig. 32.—Three-phase commutator motor driven winder at the Bartensleben Pit, Germany. When sinking is completed a second motor will be added when a nett load of 3.2 tons per wind will be wound from 1,600 ft. Each motor is 310 horse-power, synchronous speed, 300 r.p.m. Maximum speed, 370 r.p.m. Maximum winding speed, 1,575 ft. per minute.

Cylindrical and Conical Drums.—The first type of drum to be employed for winding engines was the cylindrical drum, but later the conical drum was introduced. In some cases the latter gives easier starting conditions and is beneficial to the steam engine, because the rope supporting the cage at the bank top is wound off the greatest diameter, while the rope attached to the loaded cage at the pit bottom is wound on to the least diameter, so that the empty cage partially balances the rope and the loaded cage at the start of the wind.

To illustrate the relative advantages of the cylindrical and the conical drum for the electrical or the steam drive at various speeds, Figs. 34, 35, 36, 37, 38, and 39 have been worked out, while Fig. 40 is worked out for a scroll drum, and Fig. 42 for a Koepe pulley under the same conditions as are illustrated in Figs. 36 and 37. These diagrams are worked out for the following conditions:—

Nett load, 9,000 lb.; weight of empty cage and cars, 12,000 lb.; depth, 1,600 ft; diameter of rope, 1⅝ in.; diameter of rope sheaves, 16 ft.; lead, 250 ft (approximately); cylindrical drum, 9 ft. diameter; conical drum, 9 ft. to 14 ft. diameter; with cylindrical drum and empty cage at the bank, unbalanced load, 16,800 lb.; with conical drum and empty cage at the bank, unbalanced load, 10,000 lb.

Figs. 34 and 35 are drawn for an output of 135 tons per hour. Fig. 34 represents the cylindrical drum where the maximum winding speed is 20 ft. per second. Fig 35 represents the conical drum with an equivalent winding speed. If the cylindrical drum in Fig. 34 is driven by a steam engine the horse power equivalent to the starting torque would be 678, and this starting torque has to be developed in the worst position of the cranks. The

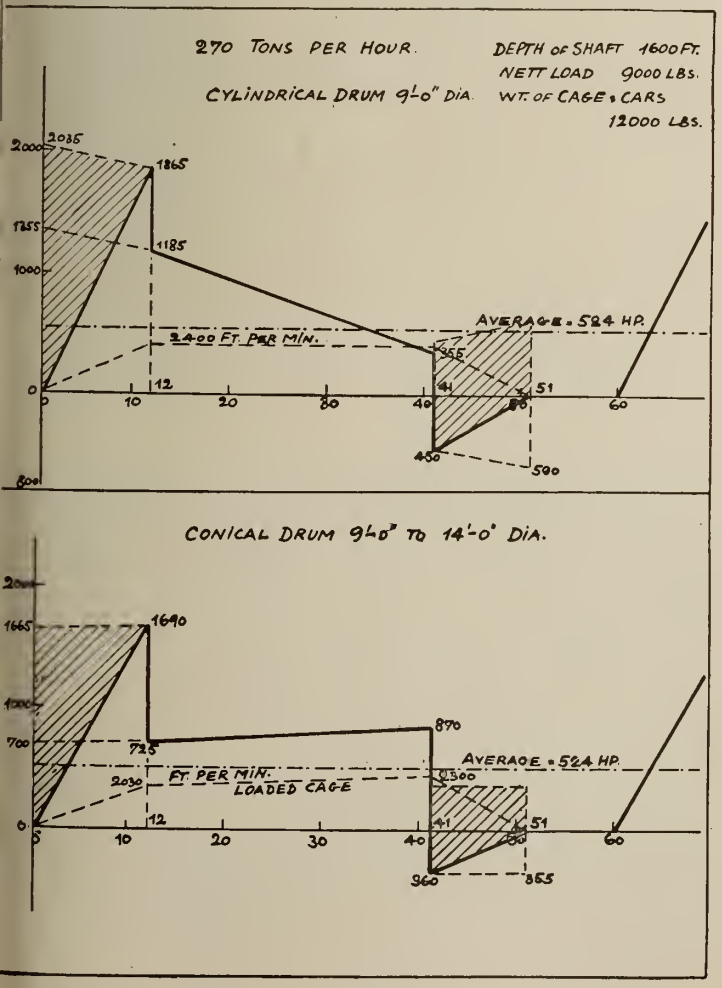


Fig. 34.—Power diagram for cylindrical drum winder, winding speed, 20 ft. per second.

Fig. 35.—Power diagram for conical drum winder, winding speed, 20 ft. per second.

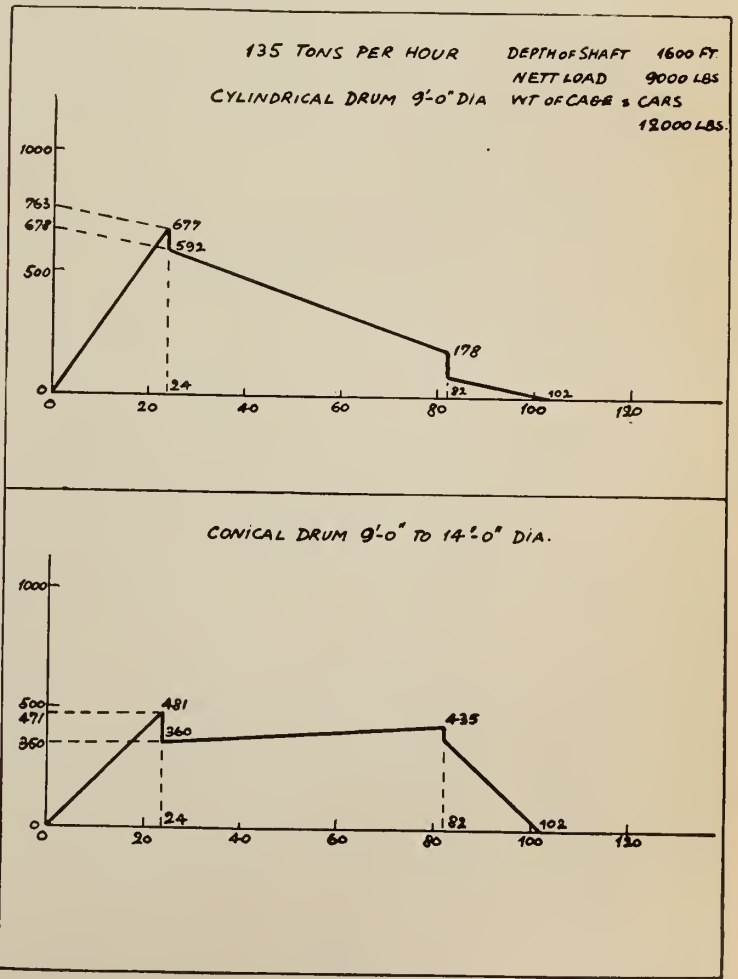


Fig. 36.—Power diagram for cylindrical drum winder, winding speed, 40 ft. per second.

Fig. 37.—Power diagram for conical drum winder, winding speed, 40 ft. per second.

horse power equivalent to the corresponding average turning moment would be 865, which gives an ample turning moment for acceleration, and the maximum speed of the engine would be 42 r.p.m.

In the case of the conical drum the horse power equivalent to the starting turning moment would be 350, and to the average turning moment 445. This horse power, however, is not sufficient to provide for the acceleration turning moment, so that an engine having a maximum horse power of 481 would be required, running at a maximum speed of 33 r.p.m.

Thus, for the cylindrical drum, an 865 horse power engine running at 42 r.p.m. is required, and for the conical drum a 481 horse power engine at 33 r.p.m. is required, so that for the cylindrical drum an engine giving 20.6 brake horse power per revolution is necessary, and for the conical drum, an engine giving 14.6. The use of the conical drum, therefore, demands a much smaller steam engine.

If the winder is driven electrically a 378 horse power motor at 42 r.m.p. would be required with the cylindrical drum, and a 290 horse power motor at 33 r.p.m. for the conical drum. If the horse power per revolution be worked it will be seen that these motors are of approximately the same size.

In this case, therefore, it would be of advantage to employ a conical drum for a steam winder, but for the electrical winder, so far as capital cost is concerned, it would be distinctly disadvantageous, because there is no saving effected with the electrical plant and the winding engine with conical drums is considerably more expensive than that with cylindrical. The maximum power, however, taken from the supply system, is reduced nearly 30%.

Figs. 36 and 37 are worked out for an output of 270 tons per hour. Fig. 36 shows the case of the cylindrical drum where the maximum speed of winding is 40 ft. per second, and Fig. 37, that of the conical drum with an equivalent speed. An inspection will show that in these cases the size of the steam engine is determined by the turning moment corresponding to the acceleration peak. For the cylindrical drum a steam engine capable of giving 2,035 horse power at 84 revolutions will be required, and for the conical drum a steam engine capable of giving 1,690 horse power at 66 revolutions will be required, i.e., a slightly larger steam engine will be required for the conical drum. It should be noted, however, that in the case of the cylindrical drum if constant acceleration is not assumed it would be possible to reduce the maximum horse power of the steam engine from 2,035 to 1,950.

Table Showing the Influence of the Different Types of Drums on the Electrically Driven Winding Engine.

	Cylindrical drum.	Conical drum.	Scroll drum.	Koepe pulley.
	Depth—1,600 ft.	Output—270 tons per hr.		
Power of motor	1,090	965	780	935
Speed of motor	84	66	62.7	97
H.P. per revolution	13	14.6	12.4	9.6
Maximum peak with Ward Leonard system	1,865	1,690	1,390	1,276
Average loss of power with 3-phase system, h.p.	325	260	170	341

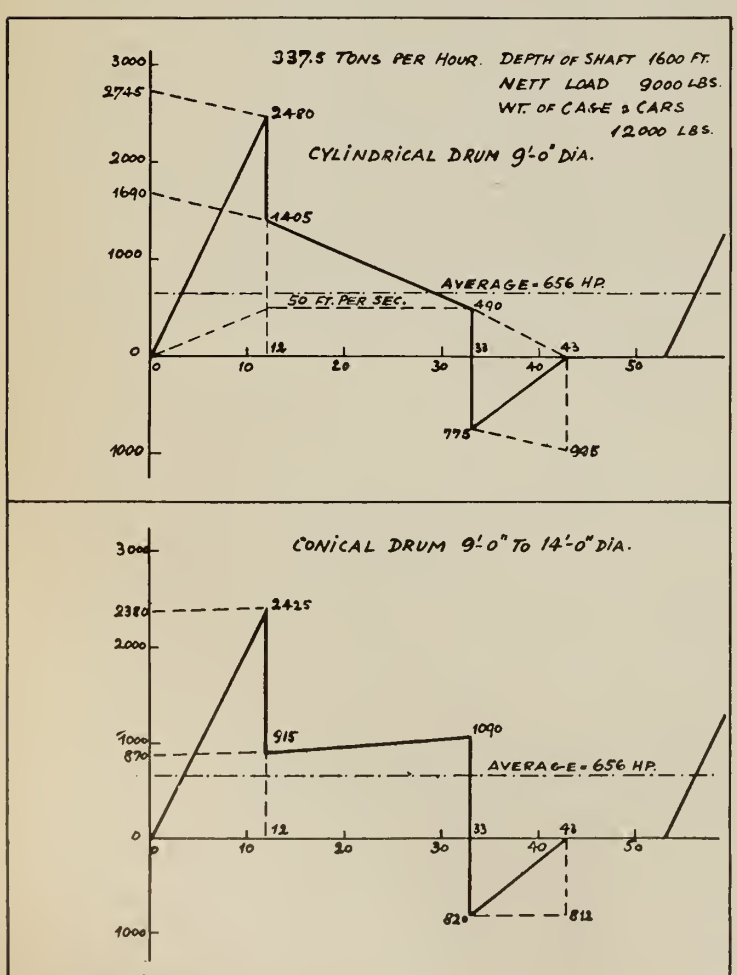

337.5 TONS PER HOUR. DEPTH OF SHAFT 1600 FT.
NETT LOAD 9000 LBS.
WT. OF CAGE & CARS 12000 LBS.
CYLINDRICAL DRUM 9'-0" DIA.
AVERAGE = 656 H.P.
50 FT. PER SEC.
CONICAL DRUM 9'-0" TO 14'-0" DIA.
AVERAGE = 656 H.P.

Fig. 38.—Power diagram for cylindrical drum winder, winding speed, 50 ft. per second.
Fig. 39.—Power diagram for conical drum winder, winding speed, 50 ft. per second.

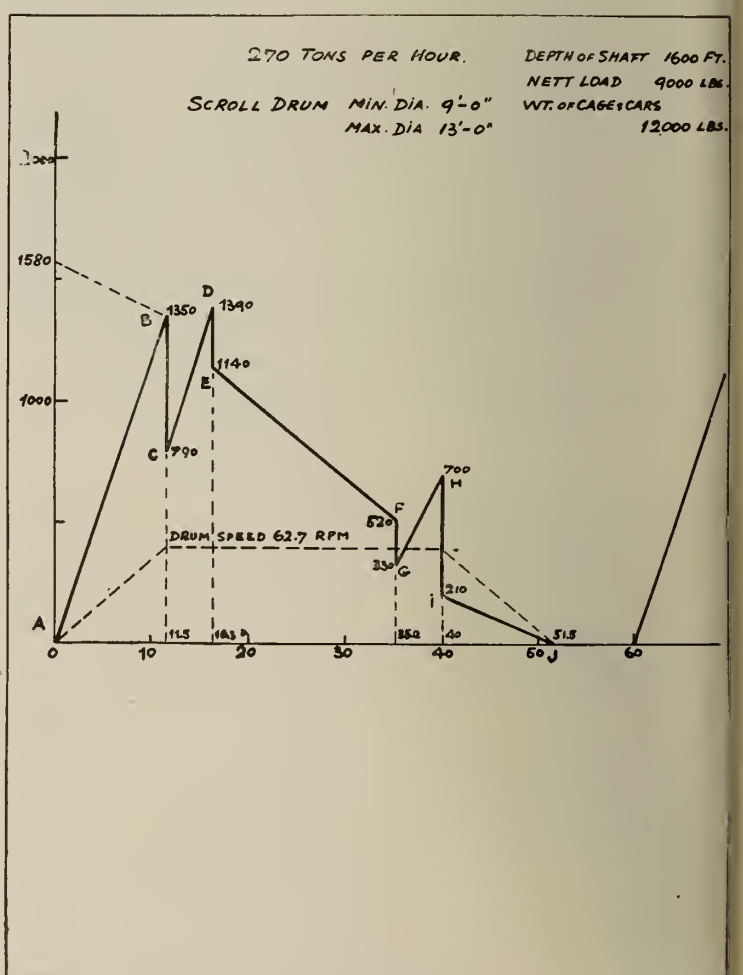

270 TONS PER HOUR.
DEPTH OF SHAFT 1600 FT.
NETT LOAD 9000 LBS.
SCROLL DRUM MIN. DIA. 9'-0"
MAX. DIA 13'-0"
WT. OF CAGE & CARS 12000 LBS.
DRUM SPEED 62.7 RPM

Fig. 40.—Power diagram for scroll drum winder, winding speed, 40 ft. per second.

Should the electrical drive be adopted, a 1,090 horse power motor at 84 revolutions would be required for the cylindrical drum, and a 965 horse power motor at 66 revolutions of the conical drum, so that a larger motor is required for the conical drum.

Figs. 38 and 39 are worked out for an output of 337.5 tons per hour. Fig. 38 shows the case of a cylindrical drum where the maximum winding speed is 50 ft. per second, while Fig. 39 shows the case of a conical drum with an equivalent winding speed.

It is easily seen that if a steam engine is used to drive this winder, a larger engine will be required for the conical drum than for the cylindrical. In the case of the electrical drive a 1,490 horse power motor at a maximum speed of 105 revolutions would be required with the cylindrical drum, and 1,390 horse power motor at a maximum speed of 83 revolutions for the conical drum.

Cylindroconical or Scroll Drum.—Fig. 40 is a power diagram for a winder provided with a cylindroconical drum worked under the same conditions as those assumed in working out Figs. 36 and 37.

In the case illustrated in Fig. 40 the small cylindrical portions at each end of the scroll drum are 9 ft. in diameter, and each carry six turns of the rope. The conical or scroll portions increase in diameter from 9 ft. to 13 ft., and each carry five turns of rope. The large cylindrical portion is 13 ft. in diameter and carries 31 turns of rope.

If a steam engine were used to drive this scroll drum winder, an engine capable of giving 1,465 horse power at a maximum speed of 62.7 revolutions will be required, and this is a smaller engine than would be required for the conical drum of Fig. 37, and slightly smaller than that required for the cylindrical drum in Fig. 36.

If this winder is driven electrically a 780 horse power motor at 62.7 revolutions would be required, and this is a smaller motor than would be required for the conical drum winder of Fig. 37, or the cylindrical drum winder of Fig. 36, the latter being about 4% smaller than that required for the cylindrical drum winder.

The capital cost of the mechanical parts of the scroll drum winder is, of course, more than the cost of that for a cylindrical winder, but it is not so great as that of the mechanical parts of a conical drum winder, and if this winder is to be driven on either the Ward Leonard or the Ilgner system, it is probable that the scroll drum winder represents one of the cheapest combinations in capital cost that can be put in to do the work.

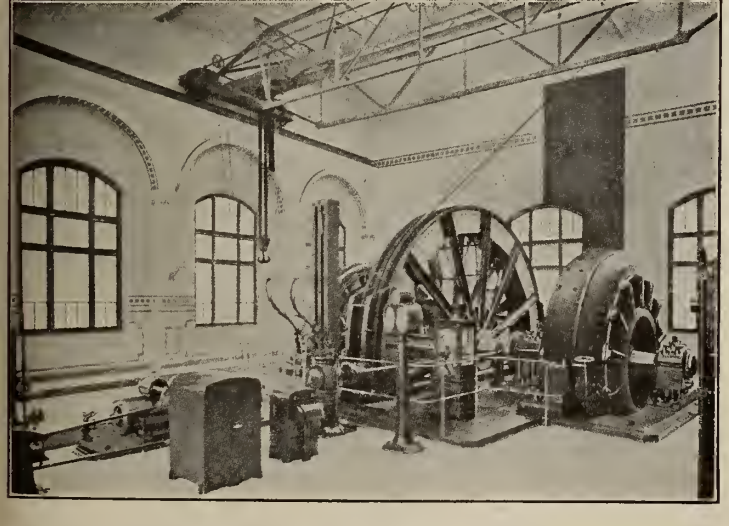


Fig. 41.—Koepe Pulley Ilgner winder at the Emscher-Lippe Pit. Depth of shaft, 3,000 ft. Nett load per wind, 6 tons. Maximum winding speed, 3,950 ft. per minute.

Should this winder be driven on the Ward Leonard system it should be pointed out that the maximum peak in power which it requires is 25% less than that required with the cylindrical drum winder.

Koepe Pulley Winder.—This type of winder is used to a considerable extent in Europe, particularly in Germany. It differs from any other type, as the rope is not wound on to and off drums but is carried over the pulley and makes contact with it for less than a single turn. Thus the rope from the ascending cage comes up the shaft over the driving pulley of the winder, and then down to the descending cage, being suitably guided by head sheaves.

It will thus be seen that the winding rope is driven by friction alone, and, consequently, there must be a very definite limit between the pull in the ascending rope and the pull of the descending rope, otherwise the rope will slip on the pulley, and, to keep the difference in pull of the two sides of the rope as small as possible, a balance rope is always necessary.

It should be noted that such a winder cannot work with a very high acceleration, otherwise slipping of the rope will take place. As the rope is bound to creep on the pulley to a certain extent, the depth indicator must frequently be reset to ensure its accuracy.

As with a Koepe pulley winder the axial length of the pulley is very short indeed compared with that of a drum on which the rope has to be wound, and as the weight of the winding drum is not increased by the rope which it is carrying, the moment of inertia of the revolving parts of a Koepe pulley winder is small, and this, together with the use of the balance rope, keeps the maximum acceleration peak comparatively small compared with that of other types of winder.

A 935 horse power motor running at maximum speed of 97 revolutions will be suitable for driving this winder, and comparing this with the motor required for the cylindrical drum in Fig. 36, it will be seen that the Koepe pulley winder can be driven with a 25% smaller motor.

As the cost of the mechanical parts of the Koepe pulley winder is not great this will be the cheapest form of winder for doing the work, and as the maximum power required at the end of the acceleration period is 1,276 horse power, or over 30% less than the maximum horse power in the case of a cylindrical drum winder, it will, if driven on the Ward Leonard system, have the least severe demand on the source of electrical supply.

Generally speaking, the Koepe pulley winder shows to the greatest advantage with deep shafts as it avoids the use of excessively long drums, and, from the electrical point of view, where the winding speed is not very high and where the acceleration period is short compared with the total time of winding. It has the disadvantage that if the rope breaks, both cages are detached from the winder.

General Conclusions Concerning Winding.—Generally speaking, the authors are of opinion that the Ward Leonard or Ilgner system of electric winding is the most suitable for vertical shafts, and for all cases where large outputs are required and short and frequent winds are made.

The three-phase winder always has the disadvantage that it cannot be so completely protected against careless handling as either the Ward Leonard or the Ilgner, but it may prove more economical for long slopes where the full speed run is a long one and the periods of acceleration are comparatively infrequent.

Regarding the choice of drums for the winding engine, the authors are of opinion that in many cases

where electrical drive is adopted, the cylindrical drum winder will prove the most suitable, but that in cases of deep shafts where the winding speed is high the seroll drum winder may prove better than the cylindrical drum winder, but that the field of application of the conical drum winder to electric winding is very small.

The authors have purposely avoided any comparison between the running costs of a steam and an electrically driven hoist or rolling mill, because each case should be considered on its own merits and comparisons made for one case will not be valid for another where conditions are different. No general comparison has any practical value, sometimes the steam engine is the more economical and sometimes the electrical plant, according to conditions, and in deciding which is the more advantageous there are other factors besides running costs to be considered.

As, however, the authors wish to see a fair comparison made in every case they should draw attention to a very fallacious method sometimes used for establishing the running cost of a steam engine, namely, either indicating the engine or measuring the water rate over an hour or two when the engine is running under the most favorable conditions, and establishing the yearly running costs from these. If tests are carried out over a prolonged period, say several months, a much higher running cost will be obtained, in some cases half as much again, as the standby losses of a steam plant are very considerable, much higher in proportion than those of an electrical plant.

The Electrical Driving of Non-Reversing Mills.

For the driving of a non-reversing mill, that is to say, a two-high, three-high, or double two-high mill, a flywheel is nearly always used in conjunction with the motor, so that the flywheel assists the motor in providing large powers necessary during the passes, when a bar is going through the rolls, thus enabling a smaller motor to be used than would be required if no flywheel were employed, and reducing the variation in power taken from the supply system.

The motor and flywheel may be either direct coupled to the mill pinions, or the flywheel may be coupled to the mill pinions and a high speed motor provided which drives the flywheel shaft through a gear, rope or belt drive, and in the case of a rope or belt drive, the flywheel itself is often made the large pulley.

There are such great advantages in driving a mill by a direct coupled motor and flywheel, that this method has been adopted in a great many instances, and it may be shown that even for a sheet mill running at so slow a speed as 28 to 30 r.p.m., there are very great advantages in employing a direct coupled motor and flywheel in spite of the high capital cost, which has led to this direct coupled drive being adopted for a number of sheet and tin-plate mills.

Where a high-speed motor is installed, the flywheel should always be coupled to the mill pinions, for it is a bad practice to instal a high speed flywheel coupled to the shaft of the high speed motor, because the stresses due to the power given up by the flywheel are undeterminate, as these depend on the rate of deceleration of the flywheel, and if these stresses had to be transmitted through gears, ropes or belts, they either have to be designed with a very large margin of safety, or else they are liable to be unduly stressed and suffer damage. It is always a good principle to couple the flywheel to the mill pinions in as direct a manner as is possible.

To enable the flywheel to assist the motor by giving up some of its stored kinetic energy so as to provide part of the power required during the passes, provision must be made so that the motor and flywheel fall in speed as the power required increases, that is to say, the motor must be artificially made to decrease in speed to a considerably greater extent than it normally would with an increase in power. This artificial increase of the fall of speed can be obtained by either of two methods:—

(1) By arranging that the speed shall steadily decrease as the power given by the motor increases. Where the mill motor is a direct current motor, this is done by providing the motor with a compound winding, which causes the necessary fall in speed without loss in power.

Where a three-phase mill motor is installed, resistances must be inserted in the rotor-circuit, which cause a definite loss in power as the speed decreases.

(2) By arranging that the speed shall commence to decrease after the motor has reached a predetermined load. This is done by introducing some electro-mechanically operated device, such as a relay, which diminishes the resistance in the shunt field of a direct current mill motor when a predetermined load is reached, or a relay, which in the case of a three-phase motor, increases the resistance in the rotor circuit.

This second method of artificially increasing the fall in speed or slip is often spoken of as automatic slip regulation, but the term "automatic" is a misleading one, because both methods are automatic, and it would be more correct to call the first method "permanent slip regulation", and the second "intermittent slip regulation."

Speed Variation.—In Europe the ordinary three-high merchant mill with roll diameters ranging from 10 in. to 18 in. is required to roll as many different sections as possible to meet the conditions of trade, and the smaller mills have to roll sections from either steel billets, scrap piles or puddled iron bars.

To meet these conditions such mills have to be able to run at a considerable number of different speeds.

It is always desirable to run at as high a speed as possible to get large outputs, but it is not possible to roll large steel billets at as high a speed as small billets, for it would be a physical impossibility for the men to catch a large and heavy steel billet thrown from the first pass of the roughing mill at a high speed.

Iron must be rolled at a much slower speed than steel, for if iron bars are rolled at a high speed they would be torn up and spoiled.

Guide rounds or squares can be rolled at a much higher speed than hand rounds or squares, for where guides can be used they hold the bar in position, but in rolling hand rounds the roller has to hold the bar in position with his tongs, and the speed of rolling must not be faster than he can walk or else he cannot follow up the bar.

The conditions for driving such a mill are very well fulfilled by the direct current compound wound compensated motor, because it can be set to run at any basis speed suitable to the section being rolled by regulating the shunt field, while the compound winding acts as a permanent slip regulator, and gives the necessary fall in speed, without wasting power, to enable the flywheel to give up part of its stored energy to assist the mill motor when required.

When the billet is out of the rolls the mill motor will not run above the basis speed to which it has been set, so that there is no difficulty in entering the next billet.

The three-phase induction motor is not at all well suited for driving such merchant mills, because its speed can only be reduced to that suited to the section being rolled by inserting resistances in the rotor circuit, and

attention has already been called in the three-phase winding engine section of this paper to the great variation of speed which takes place with change of load, when the speed of such a motor is reduced in this way.

Suppose that the mill quoted under example 1 were driven by a three-phase induction motor having a synchronous speed of 250 r.p.m., and, in order to roll large billets, such resistance was inserted in the rotor circuit to bring down the speed to 120 r.p.m. at a definite load. As soon as the bar was out of the rolls the motor would speed up, and, if the interval before the bar was re-entered was at all long, the speed of the motor would be nearly up to 250 r.p.m., so that it would be very difficult to re-enter the bar, and to re-enter a fresh billet at this speed would be almost impossible, as the rolls running at such a high speed would not grip the large billet. A mill driven in this way would be practically unworkable.

Suppose the motor were a 500 h.p. motor, then, if the speed were reduced to this extent, about 250 horse power would be wasted in the resistance if the motor was giving the turning moment corresponding to its full load. Such a three-phase drive is also extremely wasteful.

The most successful method of utilizing three-phase current to drive merchant mills working under such conditions, which has yet been devised, consists in installing a three-phase motor direct coupled to a smaller compound wound direct current motor for driving the mill and providing a rotary converter having its slip-rings connected to the slip-rings of the rotor of the three-phase motor and its commutator connected to the commutator of the direct current motor. When it is desired to run this mill motor combination at speeds below synchronous speed, the power which would otherwise be lost in resistance in the rotor circuit for the three-phase motor is converted from three-phase to direct by the rotary converter and beneficially used in the direct current motor to assist the three-phase motor in driving the mill.

This system is therefore economical and the three machines together behave something like a direct current compound wound motor. That is to say, the mill motor set can be adjusted to run at any basis speed suitable to the section being rolled by regulating the shunt field of the direct current motor, while the compound winding of this direct current motor acts as a permanent slip regulator, giving the necessary fall in speed to allow the flywheel to take effect, without entailing any loss in power.

It will also be seen that, when the bar is out of the rolls, this set will not speed up to the synchronous speed, but will be limited by the basis speed to which the direct current motor has been set. Such variable three-phase sets have been installed for driving 8 or 9 different merchant mills, with very good results, the largest being a 1,300 h.p. set, and it is quite easy to obtain a 3 to 1 speed regulation, economically, in this way, and to get any speed at all, within these limits, while the turning moment which the set can give, increases as the speed is reduced.

Conclusions Concerning Rolling Mills.—The authors are of opinion that direct current is much better adapted for driving mills and machinery in a steel works than three-phase current.

Where large reversing rolling mills are driven electrically, and the motor driving the motor generator set is supplied from a direct current system, it is found that the power supplied to the rolling mill plant can be maintained at a much steadier value than if it is supplied from a three-phase system, and with the direct current motor about a ten per cent. saving in power can be effected, as there is no loss of power in slip resistances.

With a direct current system the flywheel of the motor generator set can be utilized to a great extent for neutralizing sudden peaks of short duration in the power demand on other parts of the system, for, during such a peak, the motor generator set would not only cease to take power from the supply, but the motor can be actually reversed, and give its full output as a generator returning the energy of the flywheel as electrical energy to the supply system.

With a three-phase system, peaks in other parts of the system cannot be neutralized to anything like the same extent, for the motor can only be made to cease to take power from the supply system and cannot act as a generator returning power to the supply system.

It has been shown that the direct current compound wound motor is very well adapted to fulfil the conditions for driving three-high merchant and bar mills and that considerable complication and difficulties are involved in adapting the three-phase motor for this purpose.

Direct current motors are also particularly well adapted for driving slow speed sheet and tin-plate mills, as it is very easy to provide a slow speed direct coupled motor and gain the advantage and economy of this drive, and, as there is no loss of power in slip resistances, the direct current motor will prove from twelve to 15 per cent. more economical than the three-phase motor on this current alone.

The advantages of direct current table and live roll motors are so fully recognized that they need not be recapitulated here, but it is interesting to note that in perhaps the largest steel works on the American Continent, where the main power supply is three-phase, all the table motors are direct current and a large and costly installation of converting machinery has been provided to convert the three-phase current to direct current to supply these table motors.

It may be argued that the cost of cables with a 500 volt direct current system is much higher than for a high voltage three-phase system, but it must be remembered that a well laid out steel works is comparatively compact and the distances are relatively short, so that the cost of cables is not a very serious item, and that the additional capital cost of three-phase generating plant to produce power, which is wasted in the slip resistance, etc., will pay for a good deal of extra cable.

In steel works where there are blast furnaces and coke ovens, the modern tendency is to instal large gas engines using blast furnace or coke oven gas, both for driving the blast furnace blowers and for generating electrical power, and experience shows that a direct current gas engine power house is cheaper in capital cost and easier to operate than a three-phase power house.

Gas engine driven three-phase alternators present the most difficult problem in parallel running, and while sufficient experience has been gained in the past ten years to enable these difficulties to be overcome by proper design, the provision of very heavy flywheels is always necessary, and these largely increase the capital cost of the three-phase generators, which are intrinsically more expensive than direct current generators.

The higher the periodicity the heavier the flywheels for the three-phase generators become.

In conclusion, the authors wish to express their thanks to the Siemens Company of Canada, Limited, to Messrs. Siemens Brothers Dynamo Works, and to the Siemens Schuckertwerke for the information which they have furnished and for the assistance which they have rendered in the preparation of this paper.

WAGES OF MICHIGAN MINE WORKERS[1]

In an investigation carried on by the U. S. Department of Labor last fall, each of the Michigan copper mining companies was requested to state what increases had been made in wages or in contract rates during recent years, back to 1900, if possible. One of the most definite statements was made by the Calumet & Hecla Mining Co., which reported that its wages and rates had been changed as follows: March, 1899, a raise of 10 per cent.; January, 1901, a raise of 2½ per cent.; May, 1907, a raise of 10 per cent.; December, 1907, a cut of 10 per cent.; May, 1912, a raise of 10 per cent. Some of these changes were made by other companies on or about the months mentioned. Practically all of the companies in the district increased wages and contract prices 10 per cent. in May 1912.

Some miners work "on company account" or monthly basis, but many work on a contract basis. Contracts were formerly let on the basis of a cubic fathom of rock mined, but now they are usually let on the basis of tons mined. In no mines is the rock actually weighed, but the pay of contract miners is figured on the number of tramcar loads of rock which they blast out and which the trammers push to the shaft. In each mine the dimensions of the tramcars are the same, but the load, of course, depends on how fully they are filled or how much they are heaped.

The only mine workers that work on contract are miners and trammers. The following table shows the number of miners and trammers working on contract and monthly basis in July, 1913, just before the strike began, and shows which system the mine managers prefer, according to their own statements:

Mine	Miners on—		Trammers on—		Contract basis or shift basis preferred by management.
	Contract basis.	Monthly basis.	Contract basis.	Monthly basis.	
Ahmeek	138	....	75	42	Contract.*
Allouez	79	2	94	2	Do.*
Calumet & Hecla	652	60	(†)	(†)	Do.
Copper Range	(†)	(†)	(†)	(‡)	Do.*
Centennial	26	2	17	....	Do.*
Franklin	11	43	....	42	Do.
Hancock	....	47	....	29	Shift.
Isle Royale	56	93	....	157	Contract.*
Lake	6	34	....	25	Do.
La Salle	....	6	....	(‡)	Do.
Laurium	(**)	....	....	(‡)	Do.
Mass	....	38	....	31	(§)
Mohawk	225	14	....	126	Contract.
Oneco	....	9	....	3	Shift.
Osceola	56	2	....	‖296	Contract.
North Kearsarge	94	2	....	....	Do.*
South Kearsarge	34	42	....	....	Do.*
Quincy	140	500	....	200	Do.*
Superior	22	16	32	....	Do.*
Tamarack	73	38	....	77	Do.
Winona	64	18	....	(‡)	Do.*
Houghton	....	(‡)	....	(‡)	Do.*
Wolverine	98	....	....	86	Do.*
Total	‖1,774	a966	b218	d1,116	
Per cent. of total	64.74	35.36	16.34	83.66	

*When practicable. †Not reported. ‡All on shift basis; number not reported. **All on contract basis; number not reported. §Would have to be determined by trial. ‖North Kearsarge and South Kearsarge included. ‖Not including Copper Range and Laurium. aNot including Copper Range and Houghton. bNot including Calumet & Hecla and Copper Range. dNot including Calumet & Hecla, Copper Range, La Salle, Laurium, Winona, and Houghton.

[1]Extract from report by Department of Labor, Washington.

Most of the mine managers who prefer the contract system, or prefer it if practicable, state that they prefer it because it gives an efficient miner an opportunity to increase his earnings above the regular monthly rate. Many miners also prefer the contract system because they can earn more by that system than by the ordinary monthly rate. All pay rolls that were examined showed that the average earnings of the miners and trammers on contract were greater than the average earnings of those paid by the month. However, complaints are heard among certain contract miners because during some months their earnings would be unusually low on account of the poor rock mined, or some other run of bad luck. Contract rates are sometimes fixed by the mine captain (foreman), but more generally by him and the superintendent or general manager. Monthly wages are always determined by the management.

Of the total number of miners, 2,740, reported on either contract or monthly basis, 1,774, or 64.74 per cent., were on contract basis, and 966, or 35.26 per cent., on monthly basis. Of the total number of trammers, 1,334 reported on either contract or monthly basis, 218, or 16.34 per cent., were on contract basis, and 1,116, or 83.66 per cent., on monthly basis. Until January 1, 1913 a curious custom prevailed in all of the mines in the Michigan copper range, and it prevails yet in all mines except those of the Calumet & Hecla and its subsidiary companies. Miners that work full five and one-half day shifts or full five-night shifts are paid on the basis of having worked six shifts. Paying miners on this basis is an old Cornish custom imported into Michigan years ago. On January 1, 1913, this custom was modified by the Calumet & Hecla and its subsidiary companies, and these companies have since paid miners on night shifts for only five shifts a week, though they continue to pay miners on day shifts on the basis of having worked six shifts a week. On the same date these companies increased the rate of pay of miners "on company account" 25 cents per shift. In analyzing the tables relating to wages that follow, it is necessary to bear the old Cornish custom in mind.

An examination of the pay rolls of the mining companies involved in the strike of 1913 (except of a few companies having very small mines) was made by agents of the Bureau of Labor Statistics, and, from the figures thus secured, the tables which follow were compiled. These tables relate to the earnings of miners and trammers who together compose about half of the mine workers and who comprised the greater number of mine workers that went out on strike. All earnings shown in these tables are what the employees received after deductions had been made for materials used in the mines, such as powder, caps, fuse, and carbide, but not including deductions for medical attention, aid fund, rent, fuel, etc.

The following table shows the average number and average earnings of miners employed by each company during the 12 months prior to July 1913, in which month the strike began:

Average Daily Earnings of Michigan Copper Miners, Year Ending June 30, 1913.

Mining Company.	Six months ending Dec. 31, 1912. Average number of men.	Six months ending Dec. 31, 1912. Average earnings per day or shift.	Six months ending June 30, 1913 Average number of men.	Six months ending June 30, 1913 Average earnings per day or shift.	Total for Year ending June 30, 1913. Average number of men.	Total for Year ending June 30, 1913. Average earnings per day or shift.
No. 1	908	$3.22	754	$3.60	831	$3.39
No. 2	83	2.99	81	3.44	82	3.21
No. 3	158	3.26	120	3.59	139	3.40
No. 4	99	2.77	85	3.03	92	2.89
No. 5	256	2.79	212	3.13	234	2.94
No. 6	178	3.01	137	3.56	158	3.25
No. 7	134	3.24	123	3.37	129	3.30
No. 8	134	2.95	95	3.60	114	3.22
No. 9	51	3.58	47	3.55	49	3.57
No. 10	40	2.75	34	3.49	37	3.09
No. 11	....	....	1	3.98	....	....
No. 12	9	3.86	6	3.26	7	3.62
Totals, Nos. 1 to 12 (Calumet & Hecla and subsidiaries)	2,050	3.11	1,695	3.48	1,872	3.28
No. 13	320	2.69	281	2.70	301	2.69
No. 14	200	2.67	186	2.71	193	2.69
No. 15	365	2.67	369	2.68	367	2.68
No. 16	670	2.75	634	2.79	652	2.77
No. 17	308	2.84	253	2.81	281	2.83
No. 18	125	2.83	107	2.86	116	2.84
No. 19	112	2.71	114	2.57	113	2.64
No. 20	106	2.91	100	2.88	103	2.90
No. 21	....	....	....	....	....	....
No. 22	58	2.49	*55	*2.48	†57	†2.48
No. 23	43	2.98	48	2.66	46	2.81
No. 24	13	2.61	10	2.61	12	2.61
No. 25	36	2.63	39	2.63	38	2.63
Totals, Nos. 13 to 25..	2,356	2.74	*2,196	*2.78	†2,279	†2.74
Total all companies	4,406	2.91	*3,891	*3.08	†4,151	†2.98

*5 months; mine idle in May, 1913. †11 months; mine idle in May, 1913.

The average number of miners was found for this table by dividing the total number of shifts worked, as shown on the pay rolls, by the number of shifts that the mine was operated during each six-month period. In each of the tables that follow a similar method was adopted to find the average number of miners and trammers.

The first company shown in the preceding table is the Calumet & Hecla Co., and its subsidiary companies are numbered 2 to 12. Other companies reporting are numbered 13 to 25. The earnings of miners employed during the year by the Calumet & Hecla and subsidiary companies varied from $2.89 to $3.62 per shift and averaged $3.28. The earnings of miners employed during the year by the other companies varied from $2.48 to $2.90 per shift and averaged $2.74. The general average for all companies during the year was $2.98.

Miners do not work Saturday afternoons, hence in a month of 30 days without holiday they work only 23 shifts. But under the old Cornish custom their shift rate is computed by dividing their monthly rate by 26, because under this custom miners that work 5½-day shifts a week or 5-night shifts a week are counted as having worked 6 shifts. In other words, the monthly rate of "company account" miners is divided by 26 to arrive at the shift rate, and if a miner is absent 1 day one twenty-sixth of his monthly rate is deducted from his pay; if he is absent 2 days, two twenty-sixths of his monthly rate is deducted. If he works an extra shift on overtime work or in a month of 31 days, he is paid one twenty-sixth more than his monthly rate.

The shift rate is thus computed from the monthly rate by all companies except the Calumet & Hecla and its subsidiary companies. Prior to January 1, 1913, the Calumet and Hecla and its subsidiary companies followed the old Cornish custom, and divided the monthly rate by 26 to obtain the shift rate, but since then they have divided the monthly rate by 24 instead of 26. They did this because they stopped counting night-shift miners, who work 5 shifts a week, as having worked 6 shifts, though they continued to count day-shift miners who work 5½ shifts a week as working 6 shifts. This, in part, explains why the average shift rate of miners of the Calumet & Hecla and subsidiary companies was higher during the first six months of 1913 than it was during the last 6 months of 1912. Another reason given by the company for this increase is the increased amount of contract mining, and still another reason assigned is the increased use of the one-man drill.

It should be understood that there has been no change in the time that miners work. If they work full time they actually work 23 shifts (counting two half shifts on Saturday forenoons as one shift) in a month of 30 days without holidays.

In computing the rate per shift for contract miners, their earnings for the month are divided by the actual number of shifts that they worked, but with the Calumet & Hecla and subsidiary companies Saturday half shifts are counted as full shifts, and with the other companies Saturday half shifts are counted as full shifts, and an extra shift on Saturday night is counted.

The different methods of computing the shift rate should be considered in comparing the rates shown in the table that are paid by the Calumet & Hecla and subsidiary companies with the rates that are paid by the other companies. The rates for the first 6 months in 1913 can be put on an equal basis only by multiplying the shift rates of the Calumet & Hecla and subsidiary companies by 24 and dividing by 26, or by multiplying the shift rates of the other companies, as they appear in the table, by 26 and dividing them by 24.

If the average shown in the table for miners employed by the Calumet & Hecla and subsidiary companies during the first 6 months in 1913, $3.48 per shift, be multiplied by 24 and divided by 26, the result is $3.21 per shift, as compared with $2.78 per shift paid by other companies on the same basis.

If, however, the earnings per shift are calculated on the time actually worked—that is, on the basis of 23 shifts—the average shift rate is increased above that which is shown in the table. Taking the earnings of miners employed by the Calumet & Hecla and subsidiary companies during the first six months of 1913 and multiplying the average shift rate shown in the table by 24 and dividing by 23, the result is $3.63 per shift instead of $3.48. Taking the earnings of miners employed by the other companies during the same period and multiplying the average shift rate shown in the table by 26 and dividing by 23, the result is $3.14 per shift instead of $2.78.

The following table shows the average number and average earnings of trammers employed by each company during the 12 months prior to July, 1913, in which month the strike began.

Average Daily Earnings of Trammers, Year Ending June 30, 1913.

Mining Company.	Six months ending Dec, 31, 1912. Average number of men.	Six months ending Dec, 31, 1912. Average earnings per day or shift.	Six months ending June 30, 1913 Average number of men.	Six months ending June 30, 1913 Average earnings per day or shift.	Total for year ending June 30, 1913. Average number of men.	Total for year ending June 30, 1913. Average earnings per day or shift.
No. 1	600	$2.84	539	$2.99	570	$2.91
No. 2	62	2.54	71	2.54	67	2.54
No. 3	138	2.54	132	2.54	135	2.54
No. 4	95	2.54	87	2.54	91	2.54
No. 5	138	2.55	131	2.57	135	2.55
No. 6	132	2.73	115	2.85	124	2.78
No. 7	111	2.75	95	2.76	103	2.75
No. 8	94	2.68	103	2.73	98	2.70
No. 9	48	2.62	30	3.14	39	2.82
No. 10	26	2.61	29	2.70	28	2.66
No. 11	....	....	2	2.46	....	....
No. 12	3	2.53	2	2.46	2	2.50
Total, Nos. 1 to 12	1,447	2.71	1,336	2.80	1,392	2.75
No. 13	169	2.31	135	2.31	152	2.31
No. 14	77	2.31	72	2.32	74	2.32
No. 15	175	2.31	*143	*2.31	†160	†2.31
No. 16	207	2.51	199	2.51	203	2.51
No. 17	189	2.53	161	2.55	175	2.54
No. 18	103	2.50	94	2.49	98	2.49
No. 19	68	2.20	64	2.40	66	2.30
No. 20	95	2.38	90	2.38	92	2.38
No. 21	....	....	....	....	....	....
No. 22	55	2.31	‡50	‡2.30	**53	**2.30
No. 23	24	2.46	25	2.27	24	2.36
No. 24	4	2.36	3	2.54	3	2.43
No. 25	36	2.31	34	2.31	35	2.31
Totals, Nos. 13 to 25	1,202	2.40	§1,070	§2.41	¶1,135	¶2.40
Total, all companies	2,649	2.57	§2,406	§2.63	¶2,527	¶2.59

*5 months; not including June, 1913. †11 months; not including June, 1913. ‡5 months; mine idle in May, 1913; **11 months; mine idle in May, 1913. §Including 2 companies reporting for 5 months; ¶Including 2 companies reporting for 11 months.

As the Cornish custom has never been applied to trammers, a simpler explanation can be made of the table that relates to trammers than of the table that relates to miners. The rates per shift are figured on the same basis for all companies. The monthly earnings of contract trammers are divided by the actual number of shifts that they worked, and the monthly wages of "company account" trammers are divided by 26 or 27, since they work, when working full time, 26 shifts in a 30-day month and 27 shifts in a 31-day month, the Saturday shifts, day or night shifts, being two hours shorter than the shifts on other days.

As shown by the table, the earnings of trammers employed during the year by the Calumet & Hecla and subsidiary companies varied from $2.50 to $2.91 per shift and averaged $2.75; the earnings of trammers employed during the year by the other companies varied from $2.30 to $2.54, and averaged $2.40; and the general average for all companies during the year was $2.59.

From the pay rolls of the various companies agents of the Bureau of Labor Statistics obtained the monthly rates of all miners and trammers working on "company account" during May, 1913, and the earnings and number of shifts worked by each contract miner and trammer during that month. From the data thus secured, the rates per shift were computed, and these rates were classified by amounts, as appears in the following tables, the first of which relates to miners.

Average Earnings per Day or Shift and Average Number and per cent. of Miners Earning Each Classified Amount per Day or Shift in May, 1913.

AVERAGE NUMBER.

Company.	Average number of miners.	Average earnings per day or shift.	Miners earning each classified amount per day or shift. Under $2.	$2 and under $2.50.	$2.50 and under $3.	$3 and under $3.50.	$3.50 and under $4.	$4 and under $4.50.	$4.50 and over.
No. 1	719.3	$3.54	....	....	46.5	384.7	193.6	72.2	22.3
No. 2	65.9	3.45	....	....	4.1	46.6	5.6	3.7	5.9
No. 3	98.8	3.69	....	....	....	57.0	15.2	15.3	11.2
No. 4	79.4	3.06	....	....	52.2	19.3	3.9	3.9	....
No. 5	197.3	3.15	0.3	0.4	86.9	89.9	9.7	8.2	2.0
No. 6	139.2	3.72	....	....	11.6	61.1	24.2	22.3	20.0
No. 7	108.8	3.39	....	....	16.0	63.8	13.5	4.0	11.4
No. 8	91.0	3.57	....	....	.4	69.3	11.6	....	9.8
No. 9	46.6	3.68	....	....	.4	33.8	1.9	2.7	7.8
No. 10	31.9	3.40	....	....	....	26.4	3.2	2.2	....
No. 11	....	....	....	....	....	....	....	....	....
No. 12	....	....	....	....	....	....	....	....	....
Totals, Nos. 1 to 12	1,578.2	3.48	0.3	0.4	218.1	851.9	282.4	134.5	90.4
No. 13	251.2	2.74	....	....	220.2	29.0	2.0	....	....
No. 14	187.8	2.67	....	....	183.9	3.9	....	....	....
No. 15	355.1	2.65	1.3	1.7	327.0	22.6	2.5	....	....
No. 16	624.6	2.78	....	....	580.6	40.1	3.9	....	....
No. 17	227.1	2.90	....	1.0	168.7	36.1	11.5	8.9	0.9
No. 18	107.1	2.75	....	....	99.7	5.6	1.9	....	....
No. 19	94.0	2.63	....	66.5	11.6	11.9	4.0	....	....
No. 20	89.1	2.85	....	....	70.7	16.0	2.2	0.1	....
No 21	....	....	....	....	....	....	....	....	....
No. 22	52.3	2.45	....	12.9	39.4	....	....	....	....
No. 23	46.3	2.61	....	....	46.3	....	....	....	....
No 24	8.1	2.59	....	....	8.1	....	....	....	....
No. 25	40.3	2.50	....	15.7	22.6	2.0	....	....	....
Total, Nos. 13 to 25	2,083.0	2.73	1.3	97.8	1,778.2	167.2	28.0	9.0	0.9
Total, all companies	3,661.2	3.06	1.6	98.2	1,996.9	1,019.1	310.4	143.5	91.3

PER CENT.

No. 1	719.3	$3.54	....	....	6.5	53.5	26.9	10.0	3.1
No. 2	65.9	3.45	....	....	6.2	70.7	8.5	5.6	9.0
No. 3	98.8	3.69	....	....	....	57.7	15.4	15.5	11.3
No. 4	79.4	3.06	....	....	65.7	24.3	4.9	4.9	....
No. 5	197.3	3.15	0.2	0.2	44.0	45.6	4.9	4.2	1.0
No. 6	139.2	3.72	....	....	8.3	43.9	17.4	16.0	14.4
No. 7	108.8	3.39	....	....	14.7	58.6	12.4	3.6	10.5
No. 8	91.0	3.57	....	....	0.4	76.2	12.7	....	10.8
No. 9	46.6	3.68	....	....	0.9	72.5	4.1	5.8	16.7
No. 10	31.9	3.40	....	....	....	82.8	10.0	6.9	....
No. 11	....	....	....	....	....	....	....	....	....
No. 12	....	....	....	....	....	....	....	....	....
Total, Nos. 1 to 12	1,578.2	3.48	(*)	(*)	13.8	54.0	17.9	8.5	5.7

No. 13	251.2	2.74	....	....	87.7	11.5	0.8	....	....
No. 14	187.8	2.67	....	....	97.9	2.1	....	....	....
No. 15	351.1	2.65	0.4	0.5	92.1	6.4	0.7	....	....
No. 16	624.6	2.78	....	....	93.0	6.4	0.6	....	....
No. 17	227.1	2.70	....	0.4	74.3	15.9	5.1	3.9	0.4
No. 18	107.1	2.75	....	....	93.1	5.2	1.8	....	....
No. 19	94.0	2.63	....	70.7	12.3	12.7	4.3	....	....
No. 20	89.1	2.85	....	....	79.3	18.0	2.5	0.1	....
No. 21	....	....	....	....	....	....	....	....	....
No. 22	52.3	2.45	....	24.7	75.3	....	....	....	....
No. 23	46.3	2.61	....	....	100.0	....	....	....	....
No. 24	8.1	2.59	....	....	100.0	....	....	....	....
No. 25	40.3	2.50	....	39.0	56.1	5.0	....	....	....
Total, Nos. 13 to 25	2,083.0	2.73	0.1	4.7	85.4	8.0	1.3	0.4	(*)
Total, all companies	3,661.2	3.06	(*)	2.7	54.5	27.8	8.5	3.9	2.5

*Less than one-tenth of 1 per cent.

As appears by the second part of the table, 54 per cent. of the miners in the mines of the Calumet & Hecla and subsidiary companies earned from $3 to $3.50 per shift, and 85.4 per cent. of the miners in the mines of the other companies earned from $2.50 to $3 per shift. The average rate per shift for miners was $3.48 in the mines of the Calumet & Hecla and subsidiary companies and $2.73 in the mines of the other companies. It should be understood, however, that the rate per shift was found by dividing the monthly rates or earnings by 25 in the case of the Calumet & Hecla and subsidiary companies and by 27 in the case of other companies. As previously explained, the division is made by 25 for the former companies and by 27 for the latter companies because May was a month of 31 days. In a month of 30 days the division is made by 24 and 26, respectively.

To reduce the average shift rate of miners for the Calumet & Hecla and subsidiary companies to the same basis as the average rate for the other companies, the average rate of the former, $3.48, must be multiplied by 25 and divided by 27. This results in $3.22 as compared with the average shift rate of the other companies than the Calumet & Hecla and subsidiary companies, which is $2.73, figured on the 27 shift a month basis.

Following is a table relating to trammers, similar in form to that relating to miners:

Average Earnings per Day or Shift and Average Number and Per Cent. of Trammers Earning Each Classified Amount Per Day Shift in May, 1913.

AVERAGE NUMBER.

Company	Average number of trammers.	Average earnings per day or shift.	Trammers earning each classified amount per day or shift. Under $2.	$2 and under $2.50.	$2.50 and under $3.	$3 and under $3.50.	$3.50 and under $4.	$4 and under $4.50.	$4.50 and over.
No. 1	502.8	$3.08	0.2	31.5	240.3	115.7	100.8	14.1	0.1
No. 2	64.6	2.54	....	....	64.6	....	....	....	....
No. 3	150.6	2.54	....	....	150.6	....	....	....	....
No. 4	99.9	2.54	....	....	99.9	....	....	....	....
No. 5	127.8	2.55	....	....	127.8	....	....	....	....
No. 6	120.1	2.93	....	.3	75.1	24.7	15.4	1.1	3.6
No. 7	75.7	2.81	....	....	75.7	....	....	....	....
No. 8	104.7	2.68	....	....	89.7	15.0	....	....	....
No. 9	29.6	3.17	....	.2	8.3	17.5	3.6	....	....
No. 10	23.9	2.76	....	....	17.2	6.1	0.6	....	....
No. 11	....	....	....	....	....	....	....	....	....
No. 12	....	....	....	....	....	....	....	....	....
Totals, Nos. 1 to 12	1,299.7	2.83	0.2	32.0	949.2	179.0	120.4	15.2	3.7
No. 13	134.0	2.31	....	134.0	....	....	....	....	....
No. 14	68.6	2.33	....	68.6	....	....	....	....	....
No. 15	140.0	2.31	....	140.0	....	....	....	....	....
No. 16	174.0	2.53	....	5.2	168.8	....	....	....	....
No. 17	133.9	2.53	....	2.7	131.2	....	....	....	....
No. 18	80.3	2.48	....	5.0	75.3	....	....	....	....
No. 19	59.0	2.38	....	55.7	3.3	....	....	....	....
No. 20	72.7	2.38	....	72.7	....	....	....	....	....
No. 21	....	....	....	....	....	....	....	....	....
No. 22	51.9	2.30	....	51.9	....	....	....	....	....
No. 23	23.6	2.23	....	23.6	....	....	....	....	....
No. 24	2.2	2.62	....	....	2.2	....	....	....	....
No. 25	72.7	2.29	....	72.4	0.3	....	....	....	....
Total, Nos. 13 to 25	1,012.9	2.40	....	631.8	381.1	....	....	....	....
Total, all companies	2,312.6	2.64	0.2	663.8	1,330.3	179.0	120.4	15.2	3.7

PER CENT.

No. 1	502.8	$3.08	(*)	6.3	47.8	23.0	20.0	2.8	(*)
No. 2	64.6	2.54	....	....	100.0	....	....	....	....
No. 3	150.6	2.54	....	....	100.0	....	....	....	....
No. 4	99.9	2.54	....	....	100.0	....	....	....	....
No. 5	127.8	2.55	....	....	100.0	....	....	....	....
No. 6	120.1	2.93	....	0.2	62.5	20.6	12.8	0.9	3.0
No. 7	75.7	2.81	....	....	100.0	....	....	....	....
No. 8	104.7	2.68	....	....	85.7	14.3	....	....	....
No. 9	29.6	3.17	....	0.7	28.0	59.1	12.2	....	....
No. 10	23.9	2.76	....	....	72.0	25.5	2.5	....	....
No. 11	....	....	....	....	....	....	....	....	....
No. 12	....	....	....	....	....	....	....	....	....
Totals, Nos. 1 to 12	1,299.7	2.83	(*)	2.3	73.0	13.8	9.3	1.2	0.3

Average Earnings per Day or Shift and Average Number and Per Cent. of Trammers Earning Each Classified Amount Per Day or Shift in May, 1913.—Continued.

Company	Average number of trammers.	Average earnings per day or shift.	Trammers earning each classified amount per day or shift. Under $2.	$2 and under $2.50.	$2.50 and under $3	$3 and under $3.50.	$3.50 and under $4.	$4 and under $4.50.	$4.50 and over.
No. 13	134.0	2.31	....	100.0	....	....	....	....	....
No. 14	68.6	2.33	....	100.0	....	....	....	....	....
No. 15	140.0	2.31	....	100.0	....	....	....	....	....
No. 16	174.0	2.53	....	3.0	97.0	....	....	....	....
No. 17	133.9	2.53	....	2.0	98.0	....	....	....	....
No. 18	80.3	2.48	....	6.2	93.8	....	....	....	....
No. 19	59.0	2.38	....	94.4	5.6	....	....	....	....
No. 20	72.7	2.38	....	100.0	....	....	....	....	....
No. 21	....	....	....	....	....	....	....	....	....
No. 22	51.9	2.30	....	100.0	....	....	....	....	....
No. 23	23.6	2.23	....	100.0	....	....	....	....	....
No. 24	2.2	2.62	....	....	100.0	....	....	....	....
No. 25	72.7	2.29	....	99.6	0.4	....	....	....	....
Total, Nos. 13 to 25	1,012.9	2.40	....	62.4	37.6	....	....	....	....
Total, all companies	2,312.6	2.64	(*)	28.7	57.5	7.7	5.2	0.7	0.2

*Less than one-tenth of 1 per cent.

As appears by the second part of this table, 73 per cent. of the trammers in the mines of the Calumet & Hecla and subsidiary companies earned from $2.50 to $3 per shift and 62.4 per cent. of the trammers in the mines of the other companies earned from $2 to $2.50 per shift.

The average rate per shift of the trammers employed by the Calumet and Hecla and subsidiary companies appears as $2.83, and the average of trammers employed by other companies appears as $2.40, and both averages are figured on the same basis, that is, by dividing the monthly wages of "company account" trammers by 27 and dividing the earnings of contract trammers for the month by the number of shifts that they actually worked.

BOOK REVIEWS

MINE SAMPLING AND VALUING, by C. S. Herzig, with a Chapter on Sampling Placer Deposits by C. W. Purington—Mining and Scientific Press and The Mining Magazine—Price $2.00—For sale by Book Department, Canadian Mining Journal.

This book has been written to cover a field which has not received the attention in mining literature that it deserves. Many articles have been written on the subject, but this is the first pretentious work which has appeared since the publication of Mr. T. A. Rickard's book, "The Sampling and Estimation of Ore in a Mine."

The first part of the work, entitled Mine Sampling, deals with principles underlying mine sampling and valuing, pick analysis, instruments used, general methods, precautions necessary, geological factors, churn drilling, handling of samples, preparation of samples for assay, and assaying.

The second part, entitled Mine Valuing, deals with estimation of ore, ore in sight, calculation of profits, amortization of capital, writing reports, salting, prospects, special cases, specific gravity, and placer deposits.

The book should prove useful to all who are interested in mine sampling and valuation. It contains many hints that will be of value to the experienced man as well as to the beginner. In part it is very elementary and should prove useful to students as well as to those who are already familiar with the work.

As is not uncommon among mining engineers of a certain class, the author professes to believe that geology is of no economic importance in mining. He says: "The work of the geologist deals not at all with the commercial aspect, but with the results of cause and effect." This ridiculous statement is, however, contradicted by his later references to the importance of determining the structural features of the ore bodies and enclosing rocks. The chapter on geological factors indicates clearly that the author has some very peculiar notions about the work of mining geologists and of geology in general.

In the next there are some strange misstatements of fact. On page 106 the author says: "Despite the fact that the Calumet and Hecla lode has been worked for a number of miles on its strike and for more than two miles on the dip, with value throughout, the deep shafts of the Tamarack Company, sunk to depths of over 5,000 ft. vertically, in order to work the deeper portions of this deposit, have been unprofitable." As a matter of fact, the Calumet and Hecla lode has been worked profitably for only about two miles on its strike; it has in no place, either at the Calumet and Hecla or Tamarack, been worked for a depth of two miles on its dip, and it had not value throughout.

The Tamarack Mining Co., as the result of exploration by the very methods which Mr. Herzig describes, was enabled to mine profitably a very large portion of the Calumet lode, and paid $9,420,000 in dividends. A number of shafts were sunk. Some were profitable and some were not. The mining work at great depth depends now very largely for profit or loss on labor conditions, and the price of copper. The future labor conditions and the future price of copper are among the most important things to be considered in the valuation of the mine. We submit that cost of mining and selling price of the product might have been given more consideration in a book on mine valuation.—R. E. H.

PRACTICAL INSTRUCTIONS IN THE SEARCH FOR AND THE DETERMINATION OF USEFUL MINERALS AND RARE ORES—By Alex. McLeod—John Wiley & Son, New York—For sale by Renouf Publishing Co., 25 McGill College Avenue, Montreal.

The aim of this little book is to furnish very simple means for the determination of useful minerals. Simple tests, which enable the novice to recognize minerals are given.

The introductory portion is devoted to information concerning the prospector's pan, hardness and streak of minerals, prospecting hints, preliminary tests, surface changes, surface indications, apparatus and chemicals required for testing and hints on testing.

Methods of testing are described, and eleven tables are given, in which the minerals are classed according to easily determined characteristics. A feature is the statement of the tests which are most useful in distinguishing minerals which resemble one another.

DETAILS OF CYANIDE PRACTICE, by Herbert A. Megraw, McGraw Hill Book Co.—1914—Price $2.00 —For sale by Book Department, Canadian Mining Journal.

This book is made up of a series of articles written by Mr. Megraw after visiting cyanide plants in various parts of Canada and United States. It contains articles on the Cobalt district, including a description of the Nipissing high grade mill, by Mr. R. B. Watson, and comments on the practice, by Mr. Megraw. There are chapters devoted to the Hollinger and Dome mills at Porcupine. Other chapters deal with practice in the Black Hills, South Dakota; Telluride, Colo.; Cripple Creek, Colo.; Tonopah, Nevada; Grass Valley, California; Black Oak plant, California; the Gold Road mill, Arizona; two other Arizona mills, and the Nevada Wonder mill.

One chapter is entitled, Continuous Decantation of Slime.

The series of articles is a very interesting one, and metallurgists will find the material very well put together in this book of 211 pages.

Mr. Megraw in his articles has considered description as of less importance than discussion and correlation of facts gathered from widely different places. He has endeavored to present facts and personal opinions, in a form calculated to inform the profession in general, and to promote discussion respecting details involving diverging practice.

PERSONAL AND GENERAL

Mr. H. D. Conant, superintendent of the Lake Superior smelting works, has been appointed superintendent of the Calumet and Hecla Mining Co.'s smeltery at Hubbel, Mich.

Mr. J. B. Tyrrell has returned to Toronto after visiting gold mines in the Porcupine district.

Dr. J. M. Bell was recently at Porcupine.

Mr. F. F. Combemale, of Paris, is in Toronto. Mr. Combemale is interested in gold mines in Venezuela.

Mr. H. H. Lavery has returned from El Callao, South America, where he has been for some months assisting in the examination of mining properties.

Mr. H. P. DePencier was at the Dome mine, South Porcupine, last week.

Mr. Walter H. Aldridge, of New York City, formerly managing director of the Consolidated Mining and Smelting Company of Canada, Ltd., was married to Miss Maud Miller at Oakland, California, on March 18. Mr. and Mrs. Aldridge will reside at New Rochelle, N.Y.

Mr. J. J. Anderson, patentee of an oil-fired smelting furnace, which two or three years ago, at Van Anda, Texada island B.C., was successfully demonstrated by Mr. Thomas Kiddie, to be workable in smelting copper ores, has been at Chewelah, Washington, where the United Copper Co. is putting in a small reduction plant.

Mr. E. D. Black, of Coleman, Alberta, has resigned as pit boss in the York district of the International Coal and Coke Co.'s mines, to become inspector of mines in the Yellowhead Pass district, also in Alberta.

Mr. F. J. Crossland, of Vancouver, B.C., on March 30, read a paper, on oil seepages in British Columbia, before the local Chamber of Mines. Incidentally, he stated that he had it on the best of authority that the Canadian Government will this season send a corps of experts to British Columbia to conduct careful examinations, so that possible oil fields in that Province may be delimited.

Mr. J. J. Fingland, of Kaslo, B.C., who a few weeks ago was appointed assistant assayer in connection with the experiments in electric smelting of lead-zinc ores at Nelson, B.C., has been appointed by the Provincial Government road superintendent for the Kaslo riding.

Mr. Chas. R. Hamilton, K.C., of Nelson, B.C., last month heard evidence against and for T. Wilson, pit boss at the Crow's Nest Pass Coal Co.'s Coal Creek colliery, in Southeast Kootenay, B.C., in connection with the charge made against him by the Provincial Department of Mines of negligence in the discharge of his duties. The case arose out of the death of a man in one of the mines of the colliery, which resulted from a rope breaking, letting a car run away, the car striking the man and killing him. The neglect of duty charged was in permitting the use of a rope originally six strands, but of which two had been removed. The commissioner reserved judgment until he could carefully consider the evidence taken during the two days over which the enquiry extended.

Mr. Robert R. Hedley was at Tassoo harbor, Moresby island, of the Queen Charlotte group, British Columbia, recently in connection with shipment of several hundred tons of copper ore by the Tassoo Syndicate, of which Mr. Hedley is president. The ore was shipped to the smelting works at Tacoma, Washington.

Mr. Percy F. Horton, superintendent of the H. B. lead mine, near Salmo, B.C., was married last month to Miss Minnie Belle Price at St. Louis, Mo.

Mr. R. W. M. Hunter, finding the snow still too deep to admit of development being resumed just yet at the Pingree mine, in Nelson mining division, B.C., returned to Victoria until conditions shall be favorable for working on the property.

Mr. I. F. Laucks, of Falkenberg & Laucks, Seattle, Wash., is at the Standard Silver-Lead Mining Co.'s concentrating mill at Silverton, Slocan lake, B.C., with the object of devising a means of lessening metal losses there.

Mr. Nordegg has been on a business visit to Vancouver island, B.C.

Mr. Bruce R. Ritchie, of the engineering staff of the Consolidated Mining and Smelting Company of Canada, Ltd., has returned to Kootenay, B.C., from a visit to Montreal, Quebec.

Mr. J. M. Ruffner, general manager of the North Columbia Gold Mining Co., operating extensively in Atlin camp, is back in British Columbia, after having spent the latter part of the winter at his home in Cincinnati, Ohio.

Mr. Chas. F. Sherwin, of Riondel, Kootenay lake, B.C., superintendent of the New Canadian Metal Co.'s Bluebell lead mine, went to Minnesota last month to spend a vacation there.

Mr. Chas. Simpkins, of Coeur d'Alene, Idaho, is now superintendent for the Florence Mining Co., of Spokane, Wash., at its group of mineral claims in Ainsworth mining division, B.C.

Mr. R. J. Spry, superintendent of the British Columbia Copper Co.'s Eureka mine, near Nelson, B.C., has returned to that city after having been on a visit to London, Ont.

Mr. F. M. Sylvester, of Vancouver, B.C., general manager for the Granby Consolidated M. S. and P. Co., Ltd., was at Anyox, Observatory inlet, last month, about

the time smelting was begun at the company's smeltery there.

Mr. Frederic R. Weekes, of New York City, consulting engineer to the British Columbia Copper Co., has lately been visiting the company's mines in British Columbia in company with Mr. Frederic Keffer, the company's resident engineer and geologist.

Mr. Roy Wethered, late superintendent of the Consolidated Mining and Smelting Co.'s mines in Ainsworth camp, British Columbia, has gone to the southern part of the United States on a holiday trip.

Mr. W. P. Williams, of Blairmore, Alberta, has been appointed superintendent of the Bellevue colliery of the West Canadian Collieries, Ltd., which operates several collieries in the Blairmore-Frank district.

Mr. W. R. Wilson, of Fernie, B.C., general manager for the Crow's Nest Pass Coal Co., was in Toronto last month.

OBITUARY.

Capt. James Morrish, who in the nineties was manager of the Velvet mine, a few miles from Rossland, B.C., died recently in Cornwall, England.

The Herbert Morris Crane & Hoist Co. has published bulletin B3, describing travelling lifting gears.

The Siemens Company of Canada has received an order from the Canadian Ingersoll Rand Co. for two 380 h.p. 3-phase, 2,200 volt, 60 cycle, 146 r.p.m. induction motors of the slip ring type, provided with short-circuiting and brush-lifting device, together with two Siemens' liquid starters and cast iron mining pillars for the Acadia Coal Co., Nova Scotia. These motors are to be used for driving air compressors. Some time ago the Siemens Co. equipped the sub-station and supplied a large number of motors, cables and transformers.

The Siemens Company of Canada has received an order for 5 sets of 12,000 volt switching apparatus with three tank oil switches, panels, etc., for the Canada Cement Co. Also for 4 sets of lightning arresters, each set to consist of three horn gaps, triple pole oil immersed damping resistance, Siemens special triple pole choke coil, together with disconnecting switches.

The Smart-Turner Machine Co., Limited, Hamilton, Ont., are supplying The Deloro Mining & Reduction Co., Deloro, Ont., with one of their power vacuum pumps.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Dividends declared during the quarter ended March 31 by metalliferous mining companies operating in British Columbia amount to $551,066, as follows: Consolidated Mining and Smelting Company of Canada, Ltd., $116,088; Granby Consolidated Mining, Smelting, and Power Co., Ltd., $224,978; Hedley Gold Mining Company, $60,000; Standard Silver-Lead Mining Company, Ltd., $150,000. The Canadian Gold Fields Syndicate, Ltd., has declared a dividend and bonus, together at the rate of two-and-a-half per cent., payable on April 15, but as this will simply be a redistribution of the portion of the Consolidated Co.'s dividend on shares in that company owned by the syndicate, it is not taken into account.

With the exception of where winter conditions prevent mining being carried on to advantage while the snow lies deep, and of a restricted total output of coal at Vancouver Island mines consequent upon the reduced demand for island coal, following last year's strike of coal miners, the situation in the productive mining camps of the Province is about normal. Enthusiasts have recently given opinions at public meetings to the effect that production will be much larger this year than in 1913 and dividend payments will be nearly doubled, but it will most likely be found that such sanguine forecasts were not warranted. It is true that a substantial addition to production may be expected in the Coast district, the Granby Co. having commenced to smelt copper ore at its new works at Granby bay, Observatory inlet, and two or three small producers having lately been placed on the shipping list, while the Britannia will probably make a larger output this year than last. In addition, there are two or three lode-mines about Hazelton now shipping ore that were not similarly productive in 1913. Speaking generally, though, there is as yet little to warrant the expectation of any considerable increase in the quantity and value of mineral production in 1914 as compared with last year.

East Kootenay.

The St. Eugene lead mine in small degree and the Sullivan group to a very much larger extent, are continuing to ship ore to Trail. The output of the first-mentioned mine during the first quarter of the year has been less than 300 tons; that of the latter property has exceeded 4,000 tons. Prospecting in search of other ore bodies is being kept up in the St. Eugene, and it is hoped that success will eventually result. The Sullivan has considerable reserves of lead ore, and still larger quantities of lead-zinc ore available for extraction whenever it shall be practicable to also mine the latter.

Production of coal is being fairly well maintained at Crowsnest district collieries on the British Columbia side of the Rocky Mountain divide, but on the Alberta side conditions have been less favorable during recent months. Of the three coal-mining companies operating in Southeast Kootenay, the Hosmer Mines, Ltd., is reported to have been doing best latterly. The Crow's Nest Pass Coal Co. is working both its Michel and Coal Creek collieries, though not always at full time. The Corbin Coal and Coke Co., with unusually large deposits of coal, both underground and outcropping at the surface, is preparing for enlarged operations as soon as the snow shall melt.

West Kootenay.

In Ainsworth, Slocan, Nelson, and Trail Creek (Rossland) divisions of West Kootenay district there has been general activity during the first three months of the year, though here and there a temporary suspension of operations for two or three months, or in some instances for a shorter time, has been found necessary pending a reopening of roads or trails and passing of danger from snowslides.

Ainsworth and Slocan.

Ainsworth division has made a good showing for the first quarter of the year, with a total output of nearly 5,000 tons of ore and concentrates shipped to Trail. The quantity of ore mined was much larger, for both the Bluebell and Highland concentrate their ore. The Maestro is having more ore hauled to the lakeside for shipment; the Silver Hoard will again be shipping as

soon as the wagon-road shall be sufficiently dry to admit of heavy hauling; the Florence will soon be a shipper, development work having opened sufficient ore to allow of production being commenced; and the Utica will ere long again have transportation facilities.

Ore Receipts at Trail, B.C.

Ore receipts (including concentrates) at the Consolidated Mining and Smelting Co.'s smelting works at Trail, British Columbia, during 12 weeks of the current year, to March 26, are shown in the following table. It will be noted that rather better than seven-tenths of the ore was from mines either owned, or operated under option of purchase, by the company:

District and Mine.	From Co.'s Mines. Tons.	Custom Ore. Tons.	Total Tons.
East Kootenay—			
St. Eugene	246	....	....
Sullivan Group	4,202	....	....
			4,448
Ainsworth—			
Bluebell	....	1,876	....
Highland	1,169	....	....
Maestro	138	....	....
No. 1.	1,615	....	....
Silver Hoard	....	44	....
			4,842
Slocan—			
Black Prince	....	10	....
Cinderella	....	14	....
Colonial	....	23	....
Eastmont	....	82	....
Lone Bachelor	....	40	....
Neepawa	....	4	....
Ottawa	147	....	....
Rambler-Cariboo	....	307	....
Richmond-Eureka	136	....	....
Ruth	....	182	....
Slocan Star	....	382	....
Standard	....	3,857	....
Surprise	....	201	....
Van-Roi	....	320	....
			5,705
Nelson—			
Emerald	....	735	....
H. B.	....	1,194	....
Molly Gibson	71	....	....
Queen	....	69	....
Revell	....	9	....
Silver King	4,417	....	....
Second Relief	.....	25	....
Yankee Girl	....	230	....
Zincton	....	293	....
			7,043
Rossland—			
Blue Bird	....	38	....
Centre Star Group	37,698	....	....
Josie (Le Roi No. 2, Ltd.)	....	4,370	....
Le Roi	14,788	....	....
			56,894
Boundary—			
Sally	....	26	....
Union	....	66	....
			92
Skeena—			
American Boy	....	24	....
Silver Standard	....	758	....
			782
State of Washington (U.S.A.)—			
Ben Hur	....	4,170	....
Bonanza	....	83	....
Hope	....	116	....
Imperator-Quilp	....	365	....
Iron Creek	....	18	....
Knob Hill	....	717	....
Silver Union	....	9	....
			5,478
Totals	64,627	20,657	85,284

It should be kept in mind that the 79,806 tons shown as above as from British Columbia mines (the remaining 5,478 tons of United States ore being the difference between this quantity and the total of 85,284 tons) by no means indicates the total quantity of ore produced in the several districts from which the smelting works at Trail draws its supplies, but only the quantity sent to the Consolidated Co.'s smeltery. Much of the Slocan ore is concentrated, that sent to Trail being either first-class ore shipped crude or silver-lead concentrates, in addition to which latter there is much silver-zinc concentrate which is shipped to United States zinc reduction works. Then, only a very small proportion of the copper ore mined goes to Trail, Boundary district smelting works treating more than 5,000 tons a day and Coast district mines shipping to Tacoma, Washington. Further, much gold ore is crushed and treated in stamp-mills and only a part of the product, in the shape of concentrates caught on the tables and vanners, is sent to Trail for reduction.

Slocan.

Rambler-Cariboo.—In Slocan, the Rambler-Cariboo mine and mill have been affected by a shortage of water, but it is expected this difficulty will be removed with the melting of the snow. About Sandon, danger from snow slides has caused a cessation of work for some weeks at the Richmond-Eureka, but other mines in the neighborhood have been operated throughout the winter. Good progress is reported from the Slocan Star, where preparations are being made to start the concentrating mill after years of inactivity, so far as that part of the enterprise is concerned, all ore shipped during recent years having been sent out crude.

The Surprise has been the only shipper from the floody part of the district during recent months, but underground development has been in progress at the Noble Five, and lately development work was resumed on the Noonday.

About Slocan lake, the most activity has been at mines in the neighborhood of Silverton, namely, the Standard, Van Roi, the Silverton Mines, Ltd., Hewitt-Lorna Doone group, and the Lucky Thought, the last-mentioned being under option of purchase to the Consolidated Mining and Smelting Co. Of these mines, the Standard is the most important by far, its proportion of 5,705 tons of ore and concentrate shipped from the whole of the Slocan district in 1914, to March 26, having been 3,875 tons. The Mineral Separation American Syndicate has been experimenting with its flotation process at the concentrating mill of the Silverton Mines, Ltd., and it is reported that results have been satisfactory since Hardinge conical mills were put in and finer grinding thus provided for.

The Van-Roi Mining Co. has sent out from its office in London, England, the report for the month of February, received from the managers of its silver-lead-zinc mine and concentrating mill in Silverton camp. The mill report shows that the total amount crushed during the month was 2,269 tons of ore, of an average assay of silver 15.5 oz. to the ton, lead 2.1 per cent., and zinc 6.3 per cent. The mill was operated 510 hours. The product was 90 tons of lead concentrate, having an average assay value of silver 222.2 oz. to the ton, lead, 57 per cent., and zinc 13.8 per cent.; and 150 tons of zinc concentrate, assaying silver 59.3 oz. to the ton, lead 2.2 per cent., and zinc 40.6 per cent. The total approximate value of the mill products was $15,776. The expenditure during the month was: On development $21,120, ore-production $5,983, milling $3,277, capital and other expenditure $1,349; total $12,729. The balance to credit was $3,047. Beside ore production, there was done in mine 190 ft. of new development work.

In Slocan City division, shipments this year have been as follows: Black Prince 10 tons, Eastmont 82 tons, Neepawa 4 tons, Ottawa 147 tons; total 243 tons.

Lately it was reported that a 6 in. stringer of high grade silver ore had been cut in a crosscut adit, being driven from the lower workings of the Black Prince to cut the Two Friends vein, which is estimated to be 25 ft. farther ahead.

Nelson Mining Division.

Snow is melting so quickly on the lower slopes of the mountains that the prospecting season has opened earlier this year than usual. Already a number of

B.C. Bureau of Mines

B.C. Bureau of Mines

B.C. Bureau of Mines

B.C. Bureau of Mines

Swimming Pack-train across Stikine at Telegraph Creek

Scenes in British Columbia

Groundhog Mt.—Trail over Summit in Midsummer.

mineral claims have been staked in Nelson and Sheep Creek districts.

Development work is to be resumed shortly at both the Eureka and Pingree mining properties, situated in the mountains west of Nelson City. The British Columbia Copper Co., before suspending for the winter operations on the Eureka, developed sufficient ore to warrant a beginning being made to stope for shipment to the company's smelting works at Greenwood, Boundary district, but production cannot be undertaken to advantage until after provision shall have been made for transporting the ore to the railway. It is intended to construct an aerial tramway, the material for which is stored at Granite, several miles from the mine. On completion of this work in the spring stoping operations will be begun and development work resumed. The company's engineers report a probable tonnage developed thus far of about 20,000 tons of ore, having an average value in gold, silver and copper contents of $7 a ton. Native silver has been found to occur in places in the mine. On the Pingree an adit has been driven more than 200 ft., and the face of this working is stated to be well mineralized. Further development of this mine will be under the direction of Mr. R. W. M. Hunter, of Victoria.

A local syndicate has been formed to carry on placer mining on Forty Nine Creek, a few miles west of Nelson, and lumber for a flume has been ordered. It is stated that the syndicate has obtained control of placer leases covering four miles of ground on the creek. In early years placer miners worked successfully on the creek and obtained gold to a considerable total value.

It is announced that local men, who have during the last two years obtained many assays of materials stated to contain platinum, are now putting in a plant to have a treatment capacity of one ton a day. It is claimed that a London metallurgist has been working on the platinum problem in Nelson for some months, and that he is now supervising the erection of the plant, and "is employing the method used in Russia to secure the platinum value." One of the most active members of the syndicate is quoted as follows: "We will shortly have in operation a small plant to demonstrate that platinum exists in commercial quantity. We have spent a large sum of money on investigating the problem, and have sent samples of rock to assayers in many parts of the world. We have never attempted to sell anything. Our investigations have been carried on quietly and with the object of demonstrating that in the future the platinum industry is likely to prove of tremendous importance to the Nelson district."

Trail Creek Mining Division.

Rossland mines are the only ones in this division that are producing ore. Activity is largely restricted to the three well known groups situated on Red mountain—the Centre Star-War Eagle group, Le Roi and the Josie group. Shipments of ore to Trail during 12 weeks to March 26 totalled 56,894 tons, of which the Consolidated Co.'s mines shipped 52,486 tons, the Le Roi No. 2 Co.'s Josie group 4,370 tons (including the concentrated product of the lower grade ore treated on the property), and the Blue Bird, in the south belt of the camp, 38 tons. The last-mentioned mine is being worked on lease, after having been idle for about a year.

The Le Roi No. 2, Ltd., has sent out from its office in London, England, the report for the month of February received from the managers of that company's Josie group of mines in Rossland camp. The included information relating to ore shipments and receipts and expenditure follows: Shipped 1,350 tons of ore and 50 tons of concentrate. The receipts from the smeltery were $9,129 in payment for 871 tons of ore, and $648 for 53 tons of concentrate; sundry receipts were $200; total receipts, $9,977. Estimated costs for corresponding period were: For development $11,000; ore production $6,000, milling $700; total costs $17,700. In addition, there was expended on Capital Account $70. The costs for the month were, in all, $7,793 in excess of the total receipts. An explanation is given, as follows: "The net receipts for ore shipped were abnormally low, owing to the mine having been closed for a week during the end of January and the beginning of February. The shut down was necessary for extensive repairs to the hoist." Beside the work in connection with stoping ore there was done 481 ft. of new development.

General Notes.

While bad roads for the time being prevent hauling of ore from the Union mine, in Franklin camp, north fork of Kettle river, Boundary district, to the railway, at Lynch creek a distance of 25 to 30 miles, work is being continued in the district. A recent report was in effect that some rich silver ore had been found on his claims, distant about three miles from the Union property, by Mr. J. Gelinas. The Grand Forks Board of Trade has been informed that the Geological Survey of Canada and the Provincial Department of Mines will each send an official in this season to investigate developments since a Geological Survey party was last in that field. Extension of the railway from Lynch creek to Franklin camp is being urged on the railway company.

The Lillooet "Prospector" states that at the Broken Hill mine, in Lillooet district, "there is in sight 90 ft. of solid ore," and adds, "unlike that of most other Bridge River properties, the ore is base, and it will require a reduction plant of some magnitude to treat it successfully. The mine is virtually a quarry, and, so far as we have been able to learn, is in the hands of men quite capable, financially, of developing the proposition to a successful issue."

Information has been published relative to the value of ore shipped to Trail from the Silver Standard mine, in the neighborhood of Hazelton, Skeena River district. Receipts at the smeltery during February and March totalled 758 tons (about 730 tons dry weight). Returns for 460 tons sampled in February gave an average value of $114.40 a ton, as compared with $106.42 for 282 tons shipped last summer. If the remaining 270 tons proves to be of similar grade, the whole of the winter shipments will represent a total value in excess of $80,000. Development below the 250 ft. level is in progress, and additional mine equipment is being put in.

The annual meeting of the Sunrise Mining Co. has been held at Prince Rupert. The company's property is situated on Nine-Mile mountain, near Hazelton. Not much development work will be done until after completion of the Nine-Mile Mountain wagon road. **The** Seaton Coal Co. (formerly the Grand Trunk B. C. Coal Co.) held its fourth annual meeting in Vancouver on March 24, and the Groundhog Anthracite Coal Co. shareholders met in annual meeting in the same city on March 25. The first mentioned of these two companies last year shipped four tons of coal to Nanaimo, Vancouver island, for test purposes. Under existing transportation conditions, however, with high freight charges on the Grand Trunk Pacific Railway, there is little encouragement to ship coal in competition with other coals not similarly handicapped.

NOVA SCOTIA

Dominion Coal Outputs.—The output of the Dominion Coal Co. for the first quarter of the year compares with 1913 as follows:

	1st Quarter, 1913, tons.	1st Quarter. 1914, tons.
Cape Breton Mines..	1,092,196	1,023,000
Springhill Mines	98,987	94,624
	1,191,183	1,117,624

These figures show a decrease of about 73,000 tons. Like all other coal companies, both in Canada and in the United States, the Nova Scotian operators are feeling the lessened demand for fuel which the restriction of manufacturing and railway operations has brought about.

At the present time the Dominion Coal Co. has a more plentiful supply of labor than has been the case for six years, and because of the temporary lull in demand the men have been working with greater regularity. Some new records in production have been achieved during this first quarter. During March the long coveted mark of 19,000 tons was exceeded for one day's output, and on several occasions the collieries produced at the rate of over 20,000 tons per day. No. 2 and 9 collieries both made a new record. The output on the 25th from No. 2 colliery was 3,680 tons, and from No. 9 colliery 1,759 tons, making a total of 5,439 tons hoisted up one shaft. On the 27th No. 9 colliery hoisted 2,116 tons, and No. 2 colliery obtained 3,353 tons on the same day. This gives three new records for the company's largest colliery.

Although the weather during the first two months of the year was very cold, the winter has been free from snowstorms, and the company has been able to establish large banks of coal. It is probable that the labor supply will not be so restricted next summer as it was last year, and if so the shipments to the St. Lawrence will be larger than in any preceding season, if the trade depression does not cause greater severity in the American competition.

So far as it is possible to forecast at the present time, the opening of navigation will be later than last year, as the drift ice is very heavy in the Gulf.

Workmen's Compensation.—The Nova Scotia Government have brought forward a measure at the sitting session to appoint a commission of three or four members, "whose duty it shall be to examine into and report as to the laws in force in the Province of Nova Scotia relating to the liability of employers to make compensation to their employes for injuries received in the course of their employment; to examine into and report on the societies exempted from the operation of the existing Workmen's Compensation Act, and the terms and conditions under which societies should continue to be exempted or otherwise, and to submit a draft bill in accordance with such report."

This bill has particular reference to coal companies, at whose collieries approved relief societies are in existence. The action of the Government will meet with very general approval.

COBALT, GOWGANDA AND ELK LAKE

Right of Way—While the discovery on the Right of Way is necessarily of limited extent it yet proves to be of greater length and extent than was at first anticipated. Sixty feet of ore has been opened on the 120-ft. level of the old No. 3 shaft near the Princess line. In this 60 ft. the vein averages two in. in width with ore running between 2,500 oz. and 3,000 oz. The vein is undoubtedly an extension of No. 12 worked on the Princess mine, on which a 200 ft. ore shoot has been developed. It is hoped that the new ore body will be continuous across the property a distance of about 145 ft. It is not expected that there will be much more below the 120 ft. level as the contact is only a few ft. down at this point. The Right of Way is doing some exploration work at the No. 2 shaft at the 85 ft. level. One crosscut is prospecting territory under the office and buildings near the shaft, the other is being pushed north.

Peterson Lake.—There has so far been no disappointment in the development of the new ore body on Peterson Lake. The first car of ore that the company has ever shipped from its own workings will be shipped very shortly. It will be of high grade ore handpicked from the drift on the new vein. Twenty tons of high grade is now stored. It all has been taken from development work from the 200 ft. level. One hundred and ten ft. of drifting has been done towards the east on the new vein. In the face the vein early in the month showed similar values and width, viz., about two to three in. of high grade ore. The vein is sometimes two to three in. wide, at others it is split up into two or three stringers but the aggregate amount of high grade in the face is usually about the same. There is also good milling rock between.

The old winze on the old Kerry lease is being cleaned out at the 300 ft. level and a drill has been started at work there. From this point it is intended to catch the lead again. A crosscut will be driven on a vein of calcite until the contact with the conglomerate is reached. Four drills are working underground. At No. 1 shaft four headings are being worked all in exploration but so far nothing of any importance has been struck from this shaft.

Trethewey—The total recovery from the Trethewey mine during February was 40,000, the lowest for some months. A total of 2.640 tons were treated during the month and the average assay of heads was 20 oz. The old workings at the south end of the property contributed the main production of milling ore.

Bailey.—Development on the fifth level of the Bailey Cobalt is causing the management much satisfaction. The vein is from two to three in. wide of smaltite and native silver and in spots the ore will run very high indeed, but the average will make a good shipping grade. Outside the vein proper there is about eight in. of wall rock with much native silver showing. Altogether at the bottom level there has been opened up 200 ft. of an ore shoot. This is the vein upon which the original discovery of the Bailey was made and from which the first car of ore was taken out by an open cut in 1906. On the intervening levels the vein has not been developed with any vigor. On the fifth level the vein is about 80 ft. below the contact in the conglomerate. In view of the new policy adopted several drills have been put on development in order to put ore in sight. So far the management has been so busy taking out ore whenever it was encountered that it was not possible to place the mine in a good position as regards reserves.

Buffalo.—The mill production from the Buffalo mine for the month of February shows a recovery of 103,256 oz. a decrease of about 35,000 oz. from the previous months. Tons milled 6,163; average assay per ton 21.601 oz. Ozs. of silver paid for 73,459.

Beaver.—The veins are now being worked in the granite on the Beaver mine on the 460 ft. level. In one vein the silver contents are very high and the ore will average 2,000 oz. to the ton. On the 530 ft. level driving west on No. 3 vein another vein has been cut. In 60 ft. of drifting on No. 3 vein all in granite, the vein was one and a half in. in width of 2,500 oz. ore. Drifting westward on the same level another ore body about 4 in. in width in granite was cut. The granite on the 460 ft. level appears to be about 70 ft. long, but its depth has not been established. Granite boulders have also been cut through in the Bailey and Buffalo mines and in each case there was no diminution of silver contents in the vein.

The Keeley Mine in South Lorrain is being opened up again after lying idle for the winter months. The shaft is being pumped out. The Keeley is under a long option to the Huronian Belt syndicate, an English syndicate formed to do business in Canada with a capitalization of $1,000,000 in cash. It is learned that developments last year on the Keeley were quite satisfactory, two shoots of high grade ore being opened up, and there is every intention of prosecuting the work with vigor.

Savage.—At the present time 80 tons of ore is coming over the aerial tramway from the Savage to the McKinley-Darragh mill, three days the buckets carrying dump ore and three days ore from development underground. Last month the Savage contributed about 25,000 oz. Six drills are running at the Savage, all in development. As there is yet a large area of good conglomerate several crosscuts are being run. One drill is crosscutting towards the Nipissing, another towards Diabase Mountain, and another towards the Silver Bar line.

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

Hollinger—Remarkable strides in expansion are being made at the Hollinger mine. The foundations have been completed for the new power plant on Gillies Lake. The building, of solid concrete, will be 55 ft. by 140 ft., and has been designed to house two 4,500 cu. ft. compressors and other equipment. A novel feature in Ontario mining is the air chamber. A shaft has already been sunk on the edge of Gillies Lake. It will be taken down 230 ft. below the level of the lake. The air will be conserved in the air chamber at the bottom of the shaft by pressure of 200 ft. of water. The new power plant, which is being erected by the Canadian Mining Finance Company, will give the Hollinger and allied interests power for 110 drills. The present power plant will be used as auxiliary. The main vein has been cut at the 550 ft. level and it here shows 10 ft. of the usual grade of ore.

A sprinkler system will also be installed all through the Hollinger mine. It will cut the insurance rate very materially.

A consolidation of several old claims and prospects has been effected by Mr. C. L. Sherrill and his Buffalo associates, the centre claim being the Little Pet near the Porphyry Hill mine. The other claims are the two Woodhouse claims and the two Fogg claims. There is every intention of working the properties with all expedition. The deal involved altogether $100,000 and an initial payment of $10,000 has been made. A plant has been ordered and is now on its way to the Little Pet camp and will be installed at once.

The McIntyre mine has now opened up 200 ft. of $23 ore six ft. wide. This should enable the McIntyre to pay off its debts, which so far have been a very serious hindrance to development. The McIntyre has a large tonnage of low grade ore, but with the present mill equipment it was not possible to treat this at a profit. With a fair tonnage of high grade ore profit can be made to pay off debts and instal machinery in the mill which will raise the tonnage and decrease the costs. A very aggressive development scheme is being maintained, the big compressor at the Pearl Lake mine in addition to the McIntyre compressor furnishing air for underground work. The March production from the McIntyre reached $65,000. The heads from the mill being between $14 and $15 per ton.

Burnside—The balance of the purchase price of the Burnside claim in Kirkland Lake has been paid into a Haileybury bank since the first of the month. It is about $200,000. The payment was made by the Kirkland Lake Proprietary. Nothing is being done on the claims at present. As a matter of fact there is no further power available until the power line and installation from Charlton is completed. It is hoped that the "juice" will be available on May 1st. The power house at Charlton is completed and the stringing of wire has started. Poles are in position from Charlton to Dane.

Schumacher.—A good discovery has been made on the Schumacher property. The find was made in a crosscut at the 100-ft. level to the southwest, and is quite new. The ore body is broken up across the face of the drift, and is, in places, remarkably rich. The whole face of the drift will average well.

Maisonville.—Considerable excitement has been provoked in Maisonville Township by a strike made on the Malouf claim. On Wolf Lake the Canadian Exploration Company is working the Mogridge claim, and has started a drift at the 50-ft. level.

In Munro Township the Huronian Belt Syndicate is working a gang of men on the Dobie claims on a working option. The whole of the district from Swastika north to the Munro field is quite active.

Hollinger.—The gross profits from the Hollinger for the four weeks ending February 25 were $111,679, considerably higher than for the four weekly periods in January. The average value of ore treated was $17.50 per ton, approximate extraction 97.40 per cent., milling costs $1.313 per ton. During the period No. 8 vein was cut by a cross-cut on the 300-ft. level, and No. 4 vein was located with a diamond drill on the 425-ft. level.

Jupiter.—The shareholders of the Jupiter Mining Company ratified the deal made with the McKinley-Darragh-Savage Mining Company, whereby the latter company works the Jupiter. By this agreement the McKinley is to spend $30,000 in development before September, and if prospects justify further expenditure they will take up $50,000 in bonds and supply another $40,000 for further work. In return the Jupiter shareholders will get a half interest in a new company of $2,500,000.

Preston East Dome.—At the annual meeting of the Preston East Dome Mining Company it was shown that there was a bank balance of $9,000. The company still owns two claims immediately east of the Dome. The principal expenditure during the year was on the Silver Bar, an option on which was dropped at the beginning of the year. The directors elected were Charles L. Sherrill, Colonel D. M. Robertson, R. T. Shillington, D. J. White, and Gordon Taylor.

Robb.—Owing to the spectacular nature of some ore taken from the Jamieson property in Robb Township there has been quite a rush to that section. It is reported that this claim has been optioned to Mr. C. A. Foster, of Haileybury, on a working option basis.

The Dome Extension Mining Company has taken over its own plant and may work it later in the summer. For several months the Dome Mining Company has rented the plant as an auxiliary.

Hollinger Reserve.—The General Development Company of New York, has rented the small mill at the McIntyre mine, in order to make a run of 200 tons of ore from the Hollinger Reserve mine, which they have under option. The ore is being hauled from the mine in Ogden Township to the mill at Schumacher.

DELORO GOLD CLAIMS SOLD.

Cobalt, April 4.—The Little Pet claim, the two Fogg claims and the two Woodhouse claims in the township of Deloro, Porcupine, just south of the Big Dome Mines, and surrounding the Porphyry Hill, figure in a deal completed yesterday. These claims were sold to Mr. Charles L. Shirill, of Buffalo, N.Y., and his associates in the Homestake Mines Finance Company. The deal involves more than $100,000 in cash of which the initial payment of $10,000 was made to the owners in Haileybury yesterday afternoon.

Preparations have already been made for a plant. Two 60 horse power boilers, a hoist and a six drill compressor are on the way to the camp and will be installed within a few weeks and active operations will commence on the claims within the next two months. The Little Pet has all necessary mine buildings, including the framework of a stamp mill and the new company will immediately order machinery for a twenty ton stamp mill to be installed this summer for testing purposes.

It is quite probable that the claims will be incorporated under a company to be known as the Porcupine Pet Mines.

Mr. Shirill is well known in Porcupine being connected with the Foley-O'Brien, Dome Lake, Shirill Porcupine and other properties in that camp.

The Little Pet was formerly owned by a company of that name and $25,000 was paid on a deal for the claim. It was originally the Brydge claim, owned by John Brydge and a Haileybury syndicate and when the Little Pet Company failed to make the necessary payments it reverted to the original owners. Two shafts, one 100 feet and the other 50 feet have been sunk and this work will be continued. Some remarkably rich ore was mined by the Little Pet Company with which was associated Col. Weatherby of London, England, and Mr. Proctor Smith, of New York.

The Fogg and Woodhouse claims were also sold in the boom days of the camp but after a few payments were made they also reverted to the original owners, Mr. John Fogg, of Schumacher, and Mr. Harry Woodhouse, Mr. William Crawford and Mr. Teddy Edmunds of Haileybury, are the owners. The four claims had some good showings of gold but nothing extensive except surface work has been attempted.—Cobalt Nugget.

YUKON TERRITORY.

The Yukon Gold Co. has taken options on eight miles of Sixty-Mile river, where a gold strike recently occurred. The company has two Keystone drills on the ground. It is stated that the strike appears to be the most important made in the Yukon since the discovery of the Fairbanks field, and is much more extensive than the Chisana field.

Advices from England state that there has lately been published in London an article, by Mr. Rowland Fielding Mimm, on the Klondike auriferous gravel mining industry, which, he says, has now reached a degree of importance unsurpassed elsewhere in any field of equal area. Two companies in 1913 produced $5,000,000. The individual miner, with his rich bonanzas, has been superseded. The writer especially discusses the prospects of the Granville Company, of which Mr. Treadgold is managing director, and says that Granville will soon pay dividends on ordinary stock.

BRAZEAU COLLIERIES.

The Canadian Northern Railway Company finished its line to the mine several weeks ago, and this company has been shipping coal since the first day the steel reached the mine. The C.P.R. is finishing its line to Rocky Mountain House probably this month and will therefore provide another outlet. The stock of this company is not for sale.

VENEZUELA ORE.

A meeting of the bondholders of the Canadian Venezuela Ore Company has been called for April 9 at the Windsor Hotel, when the report of the engineer commissioned by the bondholders' committee to inspect the property in Venezuela will be read. The report is at present in the hands of Senator Curry as Chairman of the bondholders' committee. It has been summarized for presentation at the meeting on April 9 and is generally understood to be unfavorable.—Financial Times.

COBALT SHIPMENTS.

(The Daily Nugget.)

For a second week in succession nothing but high-grade material has left the Cobalt camp and seven mines figured in a total shipment of 612,965 lb. of ore which was sent out during the week ending April : The figures are just a few pounds below the shipments for the previous week when the same number of mines shipped eleven cars.

Of the shippers Crown Reserve had a high grade car for the Saxon Government from whom they hold a contract. Twenty tons of very rich ore went to Germany from the mine during the week. The Chambers-Ferland, an occasional shipper, appears on the list with a car of high-grade for Deloro. McKinley-Darragh leads off the weekly list with three cars of high with Coniagas second with two cars for their own smelter at Torold, Ont.

The shipments for the week ending April 3rd are:

	High-grade
McKinley-Darragh	193,750
Coniagas	147,400
Cobalt Townsite	63,720
Chambers-Ferland	58,690
Trethewey	47,070
Crown Reserve	40,000
Beaver	62,435
Total	612,965 lb.

The bullion shipments for the week are:

Mine.	Bars.	Ounces.	Value.
Nipissing	61	71,771.69	$41,627.58

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.) April 8, 1914.

New York Curb.	Bid.	Ask.
American Marconi	4.00	4.12
Alaska Gold	24.50	24.62
British Copper	1.87	2.00
Braden Copper	8.37	8.50
California Oil	304.00	306.00
Chino Copper	41.75	42.00
Giroux Copper	.87	1.12
Green Can.	37.00	38.00
Granby.	.....	.....
Miami Copper	23.75	24.00
Nevada Copper	15.37	15.62
Ohio Oil	182.00	188.00
Ray Cons. Copper	22.00	22.12
Standard Oil of N. Y.	218.00	220.00
Standard Oil of N. J.	407.00	409.00
Standard Oil (old)	1440.00	.....
Standard Oil (subs)	1025.00	.....
Tonopah Mining	2.06	2.25
Tonopah Belmont	7.87	8.00
Tonopah Merger	.61	.62
Inspiration Copper	17.75	18.12
Goldfield Cons.	1.50	1.62
Yukon Gold	2.75	3.12

Porcupine Stocks.	Bid.	Ask.
Apex.	.02½	.03
Dome Extension	.09	.09¼
Dome Lake	.46½	.47
Dome Mines	9.60	9.70
Foley O'Brien	.24	.28
Hollinger.	16.10	16.25
Jupiter.	.12	.12¼
McIntyre.	1.50	2.00
North Dome.	....	.15
Northern Exploration	2.25	2.75
Pearl Lake	.07½	.07¾
Plenaurum.	....	.50
Porcupine Gold	.12	.12¼
Imperial.	.02	.02¼
Preston East Dome	.02½	.02¾
Rea.	.20	.25
Swastika.	.03	.03¼
West Dome	.10	.12
Porcupine Crown	1.00	1.05
Teck Hughes	.10	.16

Cobalt Stocks.	Bid.	Ask.
Bailey.	.03½	.03⅝
Beaver.	.30	.31
Buffalo.	1.20	1.40
Canadian.	.08	.10
Chambers Ferland	.21½	.22
City of Cobalt	.49	.52
Cobalt Lake	.50	.55
Coniagas.	7.80	8.00
Crown Reserve	1.71	1.75
Foster.	.06	.08
Gifford.	.02	.03
Gould.	.03	.03¼
Great Northern	.10	.10½
Hargraves.	.02	.03
Hudson Bay	70.00	76.00
Kerr Lake	4.40	4.60
La Rose	1.53	1.58
McKinley.	.75	.80
Nipissing.	6.30	6.40
Peterson Lake	.41	.41¼
Right of Way	.04¾	.05¼
Rochester.	.02	.03
Leaf.	.01¾	.02¼
Cochrane.	.60	.62
Silver Queen	.02	.03
Timiskaming.	.15	.16
Trethewey.	.23	.25
Wettlaufer.	.06	.07
Seneca Superior	3.00	3.25

TORONTO MARKETS.

April 11—(Quotations from Canada Metal Co., Toronto).
Spelter, 5¼ cents per lb.
Lead, 5¼ cents per lb.
Tin, 40 cents per lb.
Antimony, 9 cents per lb.
Copper, casting, 15¼ cents per lb.
Electrolytic, 15¼ cents per lb.
Ingot brass, 10 to 15 cents per lb.

April 11—Pig Iron—(Quotations from Drummond, McCall & Co., Toronto):
Summerlee No. 1, $26.50 (f.o.b. Toronto).
Summerlee No. 2, $25.50 (f.o.b. Toronto).

April 11—Coal—(Quotations from Elias Rogers Co., Toronto).
Anthracite, $8.25 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

April 8.—Connellsville Coke, (f.o.b. ovens).
Furnace coke, prompt, $1.90 to $1.95 per ton.
Foundry coke, prompt, $2.40 to $2.60 per ton.

April 8.—Tin, straits, 36.80 cents.
Copper, Prime Lake, 14.75 to 15.00 cents.
Electrolytic copper, 14.45 to 14.55 cents.
Copper wire, 15.75 to 15.87½ cents.
Lead, 3.80 to 3.85 cents.
Spelter, 5.25 to 5.30 cents.
Sheet zinc (f.o.b. smelter), 7.00 cents.
Antimony, Cookson's, 7.20 to 7.25 cents.
Aluminum, 18.00 to 18.25 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, hard, 10 per cent., $46.00 to $47.50 per ounce.
Platinum, hard, 20 per cent., $49.00 to $51.50 per ounce.
Platinum, soft, $43.00 to $44.00 per ounce.
Bismuth, $1.95 to $2.15 per lb.
Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
Mar. 25.	58	26¾
" 26.	58	26¾
" 27.	58	26¾
" 28.	58	26¾
" 29.	58	26¾
" 30.	58	26¾
Apr. 1.	58⅛	26 13/16
" 2.	58⅜	26 13/16
" 3.	58½	27
" 4.	58⅜	26 13/16
" 6.	58⅜	26 13/16
" 7.	58⅝	27
" 8.	58½	26 13/16

"Tested Packings for Every Purpose"

This pamphlet is an authentic text-book---a complete illustrated guide---to standard lines of tested packings.

We shall be glad to send you a copy, gratis.

Canadian Consolidated Rubber Company, Limited

MONTREAL

Please use this Coupon ☞

Canadian Consolidated Rubber Co., Ltd., Montreal.

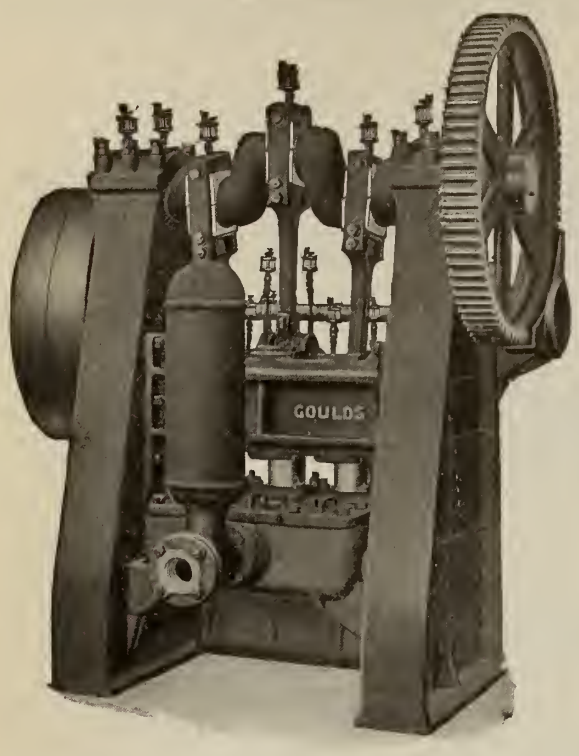
Gentlemen :

Please send me a complimentary copy of "Tested Packings for Every Purpose."

Name .....

Address .....

C.M.J.



A High Pressure Triplex Pump for Mine Service

Figure 997 Mine Pump is made for pressures up to 6000 pounds and in capacities up to 9600 gallons per hour.

It is made for belt, chain or direct drive from an electric motor or other driving mechanism.

All parts are made strong and durable to withstand the most severe conditions of mine service.

Send for Bulletin No. 109

THE CANADIAN FAIRBANKS-MORSE CO., Limited

Montreal St. John Ottawa Toronto Winnipeg Calgary Saskatoon Vancouver Victoria

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For Mining, Engineering and Shipping: For Hoisting and Haulage in Collieries and Mines: For Cableways and Aerial Ropeways: For Dredgers and Steam Shovels: Specially Flexible Ropes for Winches and Fast Hoists, Coal Towers and Cranes.

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:—

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & D
Heys, Thos. & Co

Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd

Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place - New York City
General Manager
Consolidated Arizona Smelting Co.,
Humboldt, Ariz.

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

What is your specialty ?
What is your address ?
Our readers want to know.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - - CANADA.

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

LAWYERS

Telephone Main 3813
Cable Address: "Chadwick" Toronto Western Union Code
E. M. Chadwick, K.C
David Fasken, K.C.
M. K. Cowan, K.C.
Harper Armstrng
Alexander Fasken
Hugh E. Rose, K.C.
Geo. H. Sedgewick.
James Aitchison
Beatty, Blackstock, Fasken Cowan & Chadwick.
Barristers, Solicitors, Not aries
Offices: Bank of Toronto, Cor. Wellington & Church Sts.
58 Wellington St. East Toronto

G. G. S. Lindsey, K.C.
Telephone Main 6070
Cable Address: "Lindsey," Toronto Codes, Broomhall, McNeil's 1908
Commissioner for taking affidavits in British Columbia.
counsel with
Gregory & Gooderham, Barristers and Solicitors, Canada Life Building, Toronto

Phone Main 2311 Cable Address "Segsworth" Toronto
R. F. SEGSWORTH
Barrister, Solicitor, Notary, Etc.
JARVIS BUILDING
103 Bay Street - TORONTO

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES
LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

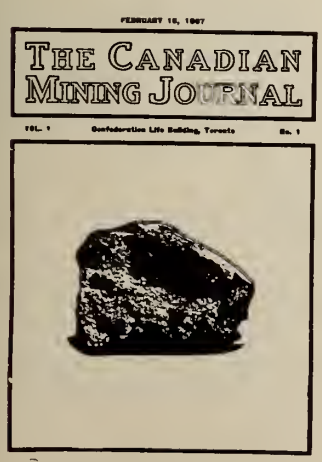
Smith & Travers Diamond Drill
Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

WANTED—DRAUGHTSMAN familiar with Mill Work. State Experience and Salary Wanted.
Moose Mountain, Limited, Sellwood, Ont.

Mine superintendent, foreman, surveyor and assayer, with fifteen years experience, open for engagement.
Address Box 5, Can. Mining Journal, Toronto.

TO INVESTORS
I want $1,500 to fit out a prospecting expedition to carry on exploration work in the new gold field. Parties putting up the money will be entitled to a claim.
Box "A". Canadian Mining Journal



The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

Guide Books to excursions of the International Geological Congress.

1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1173. Memoir 20. Gold fields of Nova Scotia, by W. Malcolm. Map not published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1279. Memoir 25. Report on the clay and shale deposits of the Western Provinces, by Heinrich Ries and Joseph Keele.

1225. Memoir 30. The basins of Nelson and Churchill rivers, by William McInnes. Map not published.

BRITISH COLUMBIA

1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1162. Map 26A. Bathurst and vicinity, Gloucester County, New Brunswick. Topography.

1163. Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.

1300. Map 100A. Bell River, Quebec. Geology.

1301. Map 101A. St. Hilaire and Rougemont Mountains, Rouville and St. Hyacinthe Counties, Quebec. Geology.

ONTARIO

1199. Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.

1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.

1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.

1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.

1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.

1304. Map 106A. Groundhog coal field, British Columbia. Geology.

1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

1298. Map 99A. Southern portion of Cranbrook map-area, East and West Kootenay, British Columbia. Geology.

YUKON and NORTH WEST TERRITORIES

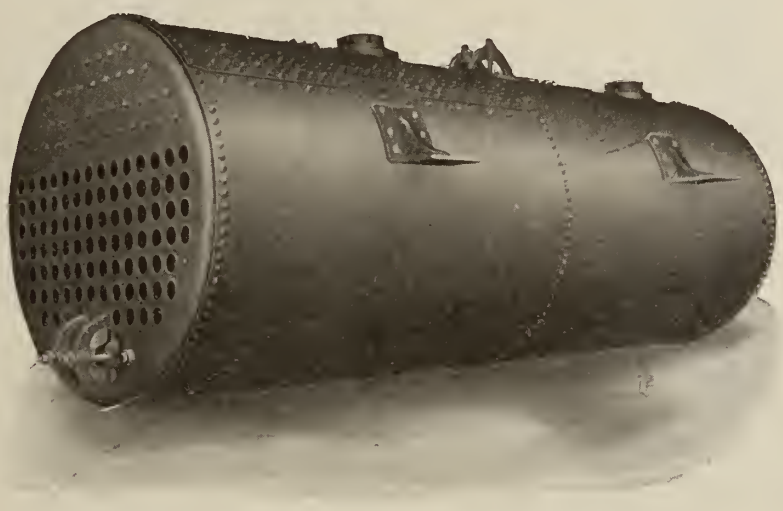
1332. Map 113A. Canadian routes to White River district, Yukon, and to Chisana district, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BOILERS



"INGLIS" STANDARD RETURN TUBULAR BOILER

We make Boilers of all kinds for any service.

For Fifty-two (52) years our boilers have been recognized as the Canadian Standard, because they combine all the essentials requisite to produce the best boiler.

Is is a pleasure for us to show prospective buyers our different types of boilers in operation.

WRITE US FOR PRICES AND SPECIFICATIONS

The John Inglis Co.,
LIMITED

Engineers and Boilermakers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL. 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office: 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

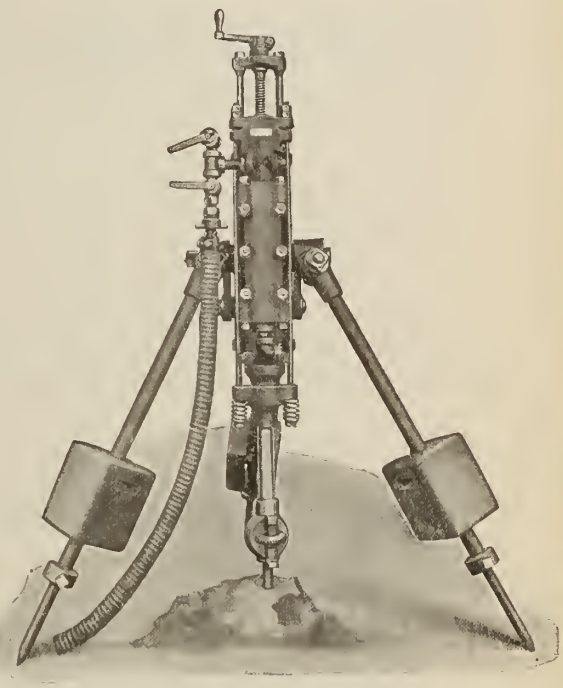
Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

¶ *Complete Bound Copies for 1913 Canadian Mining Journal, with Index, are now ready. Price $4.00 per volume. Canadian Mining Journal, 44-46 Lombard Street, Toronto.*

McKIERNAN-TERRY

CORLISS VALVE ROCK DRILLS

The Type "T. C." is a Corliss Valve machine and differs from all other rock drills in which the valve is moved by mechanical or tappet action. It is actuated by two tappets which move freely within a tappet block seated in the cylinder beneath the centre of the valve chest. The tappets, by contact with the inclined surfaces of the piston, move up and down and so impart a rotary or turning motion to the valve, by which means it is operated. So well is it balanced, that the slightest amount of power is required to move it.



For further particulars send for Bulletin to

Head Office : TORONTO, or District Sales Offices :

Montreal, Halifax, Ottawa, Cobalt, Porcupine, Fort William, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Nelson, Victoria, Vancouver. Prince Rupert

Canadian Allis-Chalmers Ltd.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.
The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co. 22
American Diamond Rock Drill Co. 16
Astley, J. W. 23

B

Bartlett, C. O., & Snow Co. 17
Bath, Henry & Son 28
Beatty, Blackstock, Fasken, Cowan & Chadwick 24
Beatty, M. & Sons, Ltd. 11
Belleville Assay Office 25
Bennett, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons 16
Blackwell, Geo. G., Sons & Co. ... 28
British Columbia, Province of ... 18
Brown & Butters 23
Burchell, Geo. B. 23
A. M. Byers Co.....inside front cover

C

Can. Consolidated Rubber Co. Ltd.. 21
Canadian Allis-Chalmers, Limited.. 29
Campbell & Deyell 25
Canadian Cleveland Drill Co 9
Canadian Copper Co. 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22, 5
Canadian Consolidated Rubber Co., Ltd. 21
Canadian Laboratories, Ltd. 25
Canadian Northern Steamships ... 6
Canadian Ingersoll-Rand Co., Ltd... 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith 23
Cohen, S. W. 23
Colvocoresses, G. M. 23
Consolidated Mining & Smelting Co 28
Coniagas Reduction Co., Ltd. 28
Curtis's & Harvey .....
.....Outside back cover

D

Dept. of Mines, Canada 26
Deloro Mining & Reduction Co... 28
DePencier, H. P. 23
Diamond Drill Contracting Co..... 16
Dominion Coal Co., Ltd. 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co. 16
Donald, Dr. J. T. 25
Drury, H. A. Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Evans, J. W. 23

F

Ferrier, W. F. 23
Fleck, Alex. 6
Flory, S., Mfg. Co. 12
Forbes, D. L. H. 23
Fowler, S. S. 23
Fraser & Chalmers of Can., Ltd.... 4
Federal Engineering Co., Ltd. 31

G

Graham, S. N. 23
Gray, John 25
Greening, B., Wire Co., Ltd. 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John 24
Hardman, J. E. 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd. 25
Heys, Thos. & Son 25
Hille, F. 24
Holman Drill Co. 20

I

Inglis, John & Co., Ltd. 27
Imperial Bank of Canada 2
Industrial & Technical Press, Ltd.. 13
International Nickel Co. 8
International Engineering Works Ltd. 11

J

James Ore Concentrator Co. .....
.....Outside back cover
Jeffrey Mfg. Co. 19
Johnson, W. S. 24
Jones & Glassco 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co. 25
Loring, F. C. 24
Lymans, Limited 9
Lands of the Algoma Central and Hudson Bay Ry. 3
Lindsey, G. G. S. 24

M

Herbert Morris Crane & Hoist Co., Ltd. 16
Morton, B. K. & Co. 18
McEvoy, James 24
Mussens, Limited .....
.....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co. 10
Nova Scotia, Province of 15
Northern Canada Supply Co., Ltd. 6

O

Orenstein-Arthur Koppel Co 5
Orford Copper Co. 8
Ontario, Province of 30

P

Peacock Bros. 7
Pickings, H. B. 24
Pyke, James W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd. 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Segsworth, W. E. 24
Siemens Co. of Canada, Ltd. 35
Smart-Turner Machine Co. 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd. .....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Standard Underground Cable Co... 15
Sullivan Machinery Co. 2
Summerhayes, Maurice W. 24
Swedish Steel & Importing Co., Ltd. 12

T

Geo. Taylor Hardware Co., Ltd.... 4
Toronto University 2
Tyrrell, J. B. 24

W

Willmott, A. B. 24
Walker Bros. 7

Lanco Balata Belting

This belt has no equal in service giving qualities where the conditions change from wet to dry. It is equally reliable for all conditions except those of heat. It is made intensely strong and is impregnated by our own secret process with PURE balata gum. Write for booklet "The Main Drive."

Federal Engineering Co., Limited
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.
Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried A. G., Germany
Northern Canada Supply Co.
Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.
Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.
Geo. Taylor Hardware Co,Ltd
Bags—
Canadian Bag Co., Ltd.
Smart-Woods, Ltd.
Ball Mills—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.
Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineering Co., Ltd.
G. Taylor Hardware Co., Ltd.
Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd
Curtis & Harvey (Canada), Limited.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.
Blowers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.
Boilers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
International Engineering Works, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
The John Inglis Co., Ltd.
Buckets—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Ltd.
Northern Canada Supply Co.
Buildings—Steel Frame—
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd
Cable — Aerial and Underground—
G. Taylor Hardware Co., Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Cableways—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
Cages—
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.
Canvas—
Smart-Woods, Ltd.
G. Taylor Hardware Co., Ltd.
Carriers—
The Herbert Morris Crane & Hoist Co., Ltd.
Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.
Orenstein Arthur Koppel Co.
Case Slings—
The Herbert Morris Crane & Hoist Co., Ltd.
Cement Machinery—
Canadian Allis-Chalmers, Ltd
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.
Chain Crane—
The Herbert Morris Crane & Hoist Co., Ltd.
Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.
Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.
Chain Slings—
The Herbert Morris Crane & Hoist Co., Ltd.
Chemists—
Canadian Laboratories.
Campbell & Deyell
Thos. Heys & Son
Milton Hersey Co.
Ledoux & Co.
Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.
Coal Cutters—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.
Coal Handling Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.
Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd.
Coal Mining Machinery—
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Bros.
Jeffrey Mfg. Co.
Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.
Compressors—Air—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd
Laurie & Lamb
Canadian Westinghouse
Can. Ingersoll-Rand Co. Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
The John Inglis Co., Ltd.
Concentrators and Jigs—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
Concrete Mixers—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.
Condensers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Bros.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.
Converters—
Canadian Westinghouse
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Waterous Engine Works
Canadian Fairbanks-Morse Co., Ltd.
Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.
Cranes—
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany
Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.
Cranes—Gantry—
The Herbert Morris Crane & Hoist Co., Ltd.
Cranes—Hand Power—
The Herbert Morris Crane & Hoist Co., Ltd.
Cranes—Overhead Traveling—
The Herbert Morris Crane & Hoist Co., Ltd.
Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.
Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith
B. Greening Wire Co., Ltd.
G. Taylor Hardware Co., Ltd.
Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.
Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.
Crushers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Lymans, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Hadfields Steel Foundry Co.
Cyanide Plants—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roessler & Hasslacher
Mussens, Ltd.
Thos. & Wm. Smith
Peacock Bros.
Derricks—
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.
Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.
Dredging Machinery—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.
Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.
Drills, Air and Hammer—
Canadian Allis-Chalmers, Ltd
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.
Drills—Core—
Can. Ingersoll-Rand Co., Ltd
Canadian Allis-Chalmers, Ltd
Standard Diamond Drill Co.
Drills—Diamond—
American Diamond Rock Drills
Sullivan Machinery Co.
Northern Canada Supply Co.
Drill Steel Sharpeners—
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
Drills—Electric—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Can. Ingersoll-Rand Co., Ltd
Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Ltd.
Orenstein-Arthur Koppel Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Conveyors—Belt—
Canadian Allis-Chalmers, Ltd
Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives
Northern Canada Supply Co.
Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.
Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.
Elevating and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.
Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.
Elevators—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Peacock Bros.
Engineering Instruments—
C. L. Berger & Sons
Peacock Bros.
Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roberts & Schaefer Co.
Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.
Waterous Engine Works Co.
The John Inglis Co., Ltd.
Engines—Gas and Gasoline—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Mussens, Ltd.
Alex. Fleck
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
M. Beatty & Sons
Canadian Westinghouse
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.
Engine—Haulage—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.
Can. Fairbanks-Morse Co.
Engines—Oil—
Peacock Bros.
Can. Fairbanks-Morse Co.
Engines—Steam—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.
Robb Engineering Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons
Laurie & Lamb
Mussens, Ltd.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.
Fans—Ventilating—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.
Feeders—Ore—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Filters—
Krupp, Fried, A. G., Germany
Friction Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.
Forges—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.
Forgings—
M. Beatty & Sons
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Bros.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :					Halifax
QUEBEC :					Montreal
ONTARIO :	Toronto,	Cobalt,	South Porcupine,	Port Arthur,	Kingston
MANITOBA :					Winnipeg
ALBERTA :					Edmonton
BRITISH COLUMBIA :	Vancouver,	Victoria,	Nelson,		Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krup, Fried. A. G., Germany
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey, (Canada), Limited
Canadian Westinghouse
Canadian Explosives
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Gears—
Canadian Westinghouse
Krupp, Fried. A G., Germany
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse
Northern Electric Co., Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Gravity Lowering Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Heaters—Feed Water—
Mussens, Ltd.
Laurie & Lamb
Canadian Westinghouse
Peacock Bros.
Fraser & Chalmers, Ltd.
G. Taylor Hardware Co., Ltd.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air Electric and Steam—
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
S. Flory Mfg. Co.
Jones & Glassco
Waterous Engine Works
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Mussens, Ltd.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Can. Cleveland Drill Co.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Jacks—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives
Peacock Bros.
Ackroyd & Best
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works
Northern Canada Supply Co.
Jones & Glassco

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.
Canadian Westinghouse
Siemens Co. of Canada, Ltd.

Locomotives—Steam—
Mussens, Ltd.
Canadian Westinghouse

Metal Merchants—
Henry Bath & Son
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Mussens, Ltd.
Northern Electric Co., Ltd.
Can. Fairbanks-Morse Co.
G. Taylor Hardware Co., Ltd.
Canadian Westinghouse
Peacock Bros.
Siemens Co. of Canada, Ltd.

Ore Sacks—
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Ore Testing Works—
Ledoux & Co.
Can. Laboratories
Milton Hersey Co., Ltd.
Campbell & Deyell

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada
Krupp, Fried, A. G., Germany
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Thos. & Wm. Smith
Peacock Bros.

Pipes—
Consolidated M. & S. Co.
Peacock Bros.
G. Taylor Hardware Co., Ltd.
Jeffrey Mfg. Co.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Canadian Westinghouse
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
G. Taylor Hardware Co., Ltd.
Jones & Glassco

Producer—Gas—
Krupp, Fried, A. G., Germany
Mussens, Ltd.

Prospecting Mills and Machinery—
Standard Diamond Drill Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
G. Taylor Hardware Co., Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Laurie & Lamb
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
G. Taylor Hardware Co., Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Can. Fairbanks-Morse Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Jeffrey Mfg. Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumatic—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.

Pumps—Sinking—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Can. Ingersoll Rand Co., Ltd.

Pumps—Steam—
Can. Ingersoll-Rand Co. Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
G. Taylor Hardware Co., Ltd.
The John Inglis Co., Ltd.

Pumps—Turbine—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Can. Cleveland Drill Co.
Krupp, Fried. A. G., Germany
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany

Rolls—Crushing—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Can. Allis-Chalmers, Ltd.

Roofing—
Paterson Mfg. Co.
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.
Geo. Taylor Hardware Co,Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.
G. Taylor Hardware Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany
Thos. Heys & Son

Screens—
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
R. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Self Landing, Self Delivery Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Separators—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Mussens, Ltd.
M. Beatty & Sons

Slime Tables—
Deister Concentrator Co.
James Ore Concentrator
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Slings—
The Herbert Morris Crane & Hoist Co., Ltd.

Smelting Machinery—
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.

Stamp Mills—
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drills—
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A G., Germany
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd
G. Taylor Hardware Co., Ltd.

Steel—Tool—
Mussens, Ltd.
Thos. & Wm. Smith
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley
C. L. Berger

Switchboards—
Canadian Westinghouse
Can. Allis-Chalmers, Ltd.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Tanks—Cyanide, Etc.—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Terminals—Cable—
Standard Underground Cable Co. of Canada, Ltd.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.

Transformers—
Canadian Westinghouse
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Peacock Bros.
Siemens Co. of Canada, Ltd.

Transits—
C. L. Berger & Sons
W. F. Stanley
Peacock Bros.

Tractors—Oil—
Can. Fairbanks-Morse Co., Ltd.

Tube Mills—
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.

Turbines—
Canadian Westinghouse
Peacock Bros.
Laurie & Lamb
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd
International Engineering Works, Ltd.

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Winding Engines—
Waterous Engine Works
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Wire Cloth—
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.

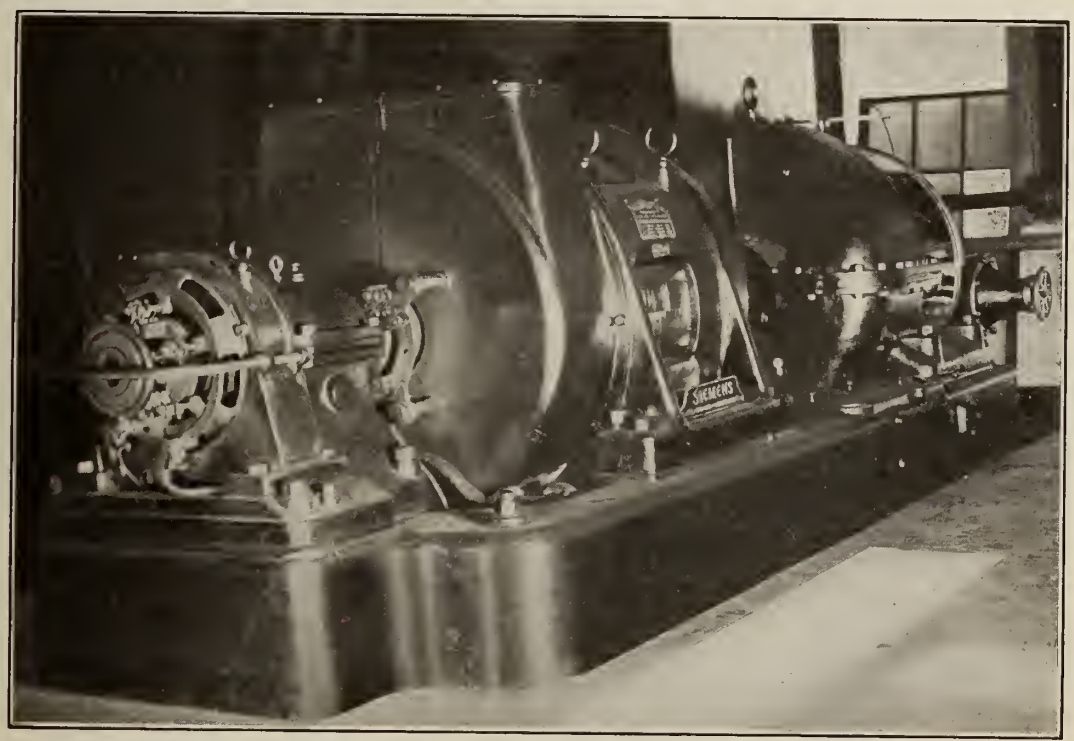
Wire—Railway, Feeder and Trolley—
Standard Underground Cable Co. of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS—SCHUCKERT | SIEMENS & HALSKE



Siemens 750 K.W., 3,600 R.P.M. Turbo Generator supplied to the Nova Scotia Steel and Coal Company, Nova Scotia.

The following Siemens **Turbo Generators** have been supplied or are on order for Canada.

1—4000 K.W. Edmonton.
1—3000 K.W. Regina.
1—2500 K.W. Dominion Coal Co.
1—2000 K.W. Dawson City
1—2000 K.W. Dawson City.
1—2000 K.W. Dawson City.
1—2000 K.W. Edmonton.
1—1500 K.W. Regina.
1—1500 K.W. Moose Jaw.
1—1500 K.W. Regina.
1—1200 K.W. Lethbridge.
1— 750 K.W. Nova Scotia Steel & Coal Co.
1— 675 K.W. Medicine Hat.
1— 675 K.W. Medicine Hat.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Wayagamack Pulp & Paper Co.

The Siemens Companies undertake the complete electrical equipment of Mines, Power Houses and Transformer Stations.

Siemens Company of Canada, Limited

HEAD OFFICE
TRANSPORTATION BUILDING - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

Detail of Oiling System for Motors

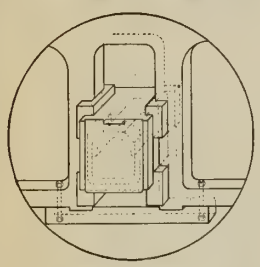


Diagram of Vauclain Gib

Vauclain Gib, removed.

One of the most important developments in the mining industry.

The new type Baldwin-Westinghouse Electric Mine Locomotive is an excellent example of the rapid progress that has been made during the past few years in the design of mining apparatus.

The Cast-Steel Bar Frame gives great strength with least weight; permits easy access to, and excellent ventilation for the motors.

The Vauclain Removable Gib greatly facilitates the removal of journal boxes and permits inspection or replacement of all wearing parts with a small cost of time and labor.

The Oil and Waste Lubricating System for the motors, with specially designed bearings for long life in service, has been adopted as standard after years of investigation.

The Commutating Pole Motors insure sparkless commutation at all loads. As a result, the commutator and brushes are long lived and require little attention; brush renewals are seldom required, and carbon and copper dust inside the motor is practically eliminated.

These features are but a few out of many which give the user the greatest possible service. You can obtain full information about these locomotives by addressing nearest office.

Canadian Westinghouse Co., Ltd.

Hamilton, Ont.

TORONTO — Traders Bank Bldg.
MONTREAL — 52 Victoria Square
OTTAWA — Ahern & Soper, Ltd.
HALIFAX — Telephone Bldg.
WINNIPEG — 158 Portage Ave. E.
CALGARY — Grain Exchange Bldg.
VANCOUVER — Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

— FOR REGULATIONS, MAPS, ETC., APPLY TO —

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M.A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— Published by —

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

— which also publishes —

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*
CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*
PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*
CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*
CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

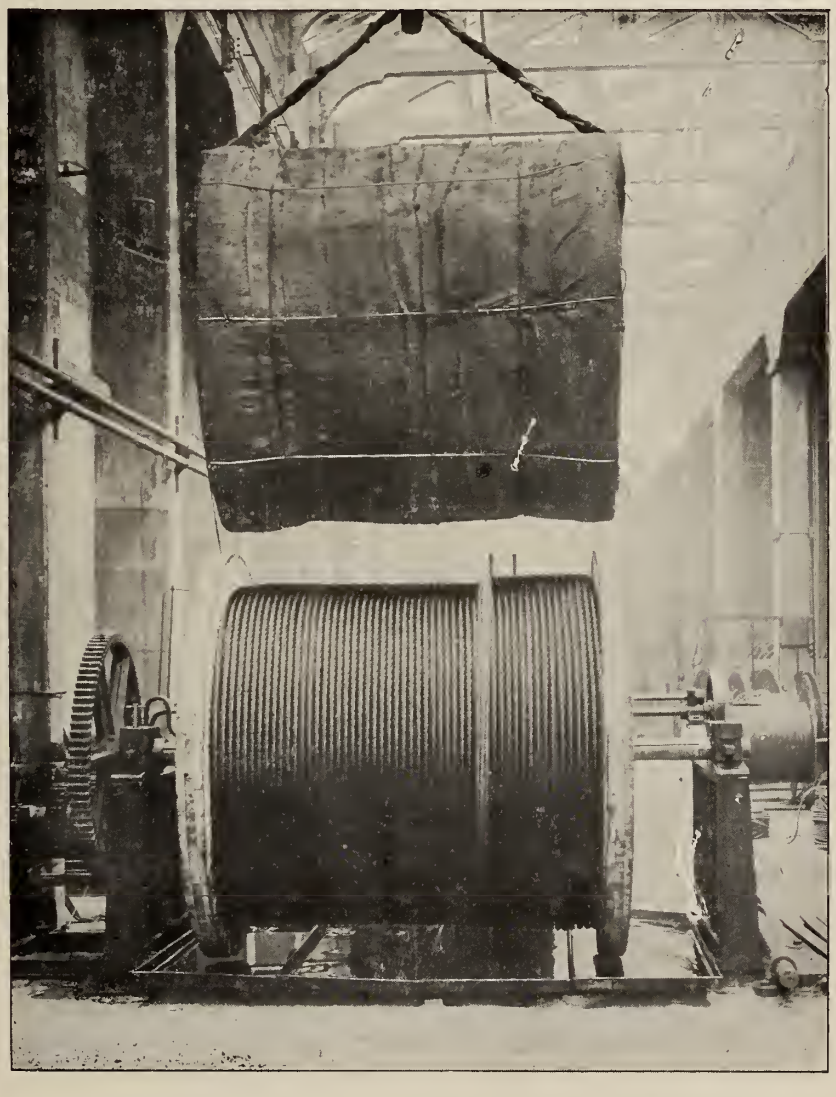
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.

The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

CURTIS'S & HARVEY (CANADA) LIMITED
DRAGON BRAND

Best Quality Only

EXPLOSIVES

400 St. James Street,
MONTREAL

MAY 1, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

OL. XXXV TORONTO No. 9

THE DRILL THAT DRILLS

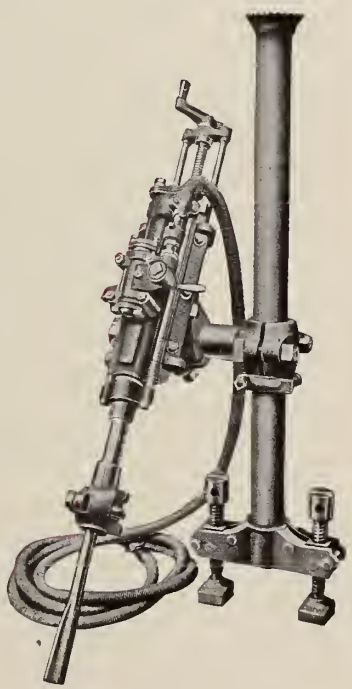
Holman Steel Rock Drills are not only low in maintenance costs but are fast drilling machines.

On a well known Cobalt property ONE Holman 3¼ Steel Rock Drill drove a drift in DIABASE, 8 feet by 6 feet by 138 ft. long, in fifty-four shifts.

AVERAGE ADVANCE Per shift 2.55 feet.

This mine has the hardest rock in the Cobalt Camp.

Size for size the Holman Steel Rock Drill will bore more footage over long periods of time than any Rock Drill on the market.



Put an end to your Drilling Troubles

by ordering

HOLMAN STEEL ROCK DRILLS

THE DRILL YOU WILL FINALLY BUY

Write for Catalogue No. 51 to the nearest office of the CANADIAN SALES AGENTS

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER 101 Water St.
QUEBEC 31 St. Louis St.
ST. JOHN, N.B. 57 Symthe St.
HALIFAX 78 Granville St.

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For Mining, Engineering and Shipping: For Hoisting and Haulage in Collieries and Mines: For Cableways and Aerial Ropeways: For Dredgers and Steam Shovels: Specially Flexible Ropes for Winches and Fast Hoists, Coal Towers and Cranes.

OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:—

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

Periodicals Which Cover Exclusively Canada's Basic Industries

Canadian Mining Journal

Devoted to the industry and science of mining and metallurgy. Published twice a month. Subscription, $2.00 a year to any address in Canada and $3.00 elsewhere.

Pulp and Paper Magazine

Devoted to the industry and science of Pulp and Paper making. Published twice a month subscription, $2.00 a year to any address in Canada. Elsewhere $2.50.

Canadian Textile Journal

Devoted to the manufacture of Textiles and the science of Textile Fibres. Subscription, $2.00 a year to any address in Canada. Elsewhere $2.50.

Canadian Miller and Cerealist

Devoted to the industry of Milling, Practical Flour Milling, and to the science of Grain and Grain Products. Published monthly. Subscription, $1.00 a year to any address in Canada. Elsewhere. $1.50.

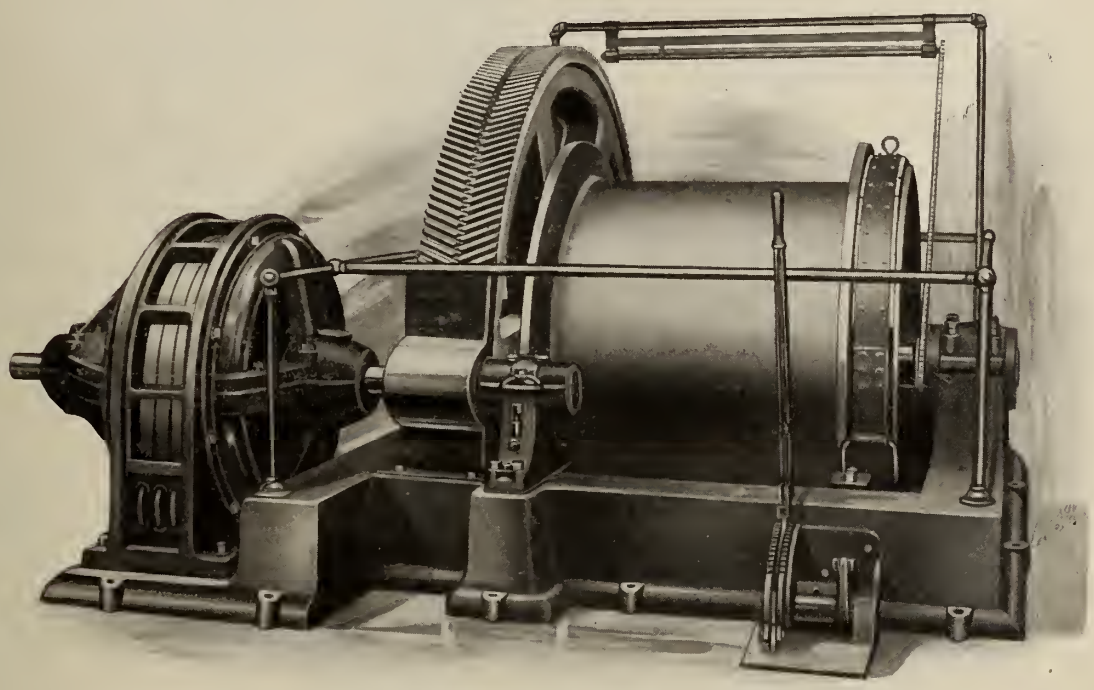
Canadian Fisherman

Devoted to the industry of Fishing, the science of Fish Culture and the use and value of Fish Products. Published monthly. Subscription $1.00 a year to any address in Canada. Elsewhere $1.50.

All communications regarding any of the above magazines will receive prompt attention when addressed to any of the following offices:

35-45 St. Alexander St., Montreal, Que. 44-46 Lombard St., Toronto, Ont. 206 Broadway, New York, N.Y.

OTTUMWA HOISTS



This cut represents our Electric Hoist, with "Wuest" cut steel herringbone gear, equipped with band brake and a screw indicator, and can be made for any desired speed and in all sizes, and adapted for slope or shaft work. Full particulars and estimates upon application.

Ottumwa Hoists are made for all requirements. Tell us about your hoisting problems, and we will recommend the type of hoist best suited for your needs.

We again call the attention of mining engineers to the heavy steel construction of all KENNEDY MINING, MILLING AND CRUSHING MACHINERY, also to the efficiency of the KENNEDY TUBE MILL for wet or dry grinding, and to the COMBINATION BALL AND TUBE MILL. This mill is intended for reducing ½ inch and under to approximately 150 mesh for Cyaniding. The cost of installing a Mill of this kind is slight considering the work it will accomplish.

Specifications and estimates furnished for complete Mining, Milling and Cyaniding plants.

FJAB Drill Steel, hollow or solid, stands for quality, uniformity, reliability, economy.

ONCE ADOPTED, ALWAYS USED

Rock & Power Machinery

Limited

Agents in Canada for the Ottumwa Iron Works and Kennedy Mfg. & Engineering Co. also agents for the Gramm Motor Truck and Troy "Motor Truck Trailers".

HEAD OFFICE: 12 King Street East, Toronto. Ont.

BRANCH OFFICES:

VANCOUVER; MONTREAL; HALIFAX; COBALT; SUDBURY;
AND IN THE KING EDWARD HOTEL, TORONTO

Imperial Bank
of Canada
Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Subscribed	$7,000,000
Capital Paid Up	6,992,000
Reserve Fund	7,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

SAFE MINERS' SAFETY LAMPS
with Hailwood's Patent Impregnable Magnetic Lock

Manufactured by the Worlds' Safety Lamp Experts

ACKROYD & BEST, LTD.,
Morley, Leeds, England

Specialists in Miner's Lamps and Equipment for same; Hailwood's Patent Fool-proof, Flame-proof, Underground Relighting Machines; Lamproom Lighting and Unlocking Machines; Cleaning Machines; Filling Machines; Iron Lampstands; Cleaning Benches, etc., etc. For full particulars apply:

Ackroyd & Best, Ltd.
No. 2 Arrott Power Buildings, Barker Place,
Pittsburg, Pa., U.S.A.
Telephone Nos. P. & A. Tel. Main 2217 / Bell " Grant 1619

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

Courses in—

1—CIVIL ENGINEERING
2—MINING ENGINEERING
3—MECHANICAL ENGINEERING
4—ARCHITECTURE
5—ANALYTICAL and APPLIED CHEMISTRY
6—CHEMICAL ENGINEERING
7—ELECTRICAL ENGINEERING
8—METALLURGICAL ENGINEERING

Leading to ACADEMIC and PROFESSIONAL Degrees.

For Calendar and other information apply to the Secretary,

A. T. LAING

Core Test Your Mines or Mineral Lands with Sullivan Diamond Drills

Sullivan Bravo Diamond Drill, operated by Coolies, North China.

The cores which these drills remove, show most accurately, quickly and cheaply, how wide the vein is, or how deep the ore body lies.

We are contractors for core drilling—the oldest and most reliable in the business. If you employ us to core drill your mines or ore lands, you can depend absolutely on the accuracy of the records thus secured. Cores taken with Sullivan Drills by Sullivan Contracting crews, are accepted by mining engineers and mineral land owners the country over as FINAL AUTHORITY on the deposits from which they were taken, whether secured last month, last year or last century.

Haven't you got some holes to drill?

Send for Prices and Bulletin 665-A

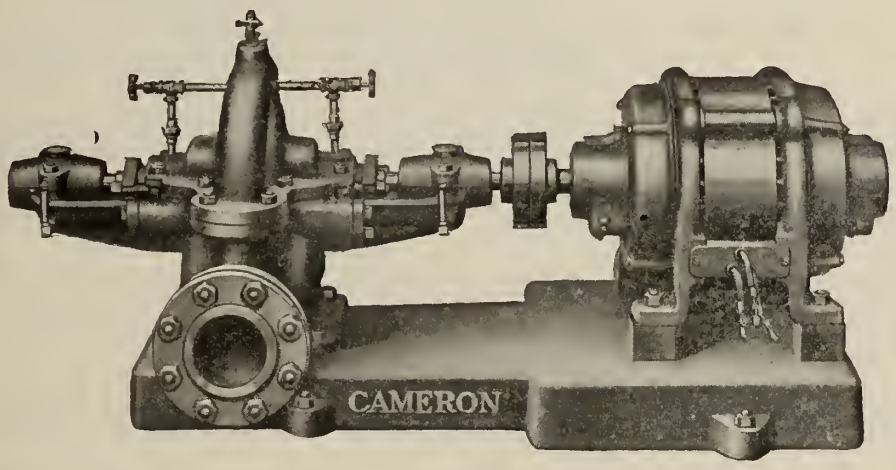
Air Compressors **Rock Drills** **Coal Cutters** **Stopers**

Sullivan Machinery Company
122 So. Michigan Ave., Chicago.

MONTREAL **COBALT** **NELSON B.C.** **VANCOUVER**

CAMERON
CENTRIFUGAL
PUMPS

Made by the Builders of Cameron Steam Pumps



SINGLE STAGE
MULTI-STAGE
BELT, MOTOR AND
TURBINE DRIVEN

DESIGNED BY EXPERTS AND MADE BY CAMERON

SOLE CANADIAN AGENTS

CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

Write Nearest Branch Office for Further Information and Catalogues

Send Us the Particulars of Your Requirements

Blake Crushers	Shoes and Dies	Trommels
Dodge Crushers	Stamp Batteries	Roasters
Gyratory Crushers	Compressors	Dryers
Crushing Rolls	Hoists	Smelting Furnaces
Huntington Mills	Engines	Converters
Chilian Mills	Boilers	Centrifugal Pumps
Tube Mills	Jigs	Steam Turbines

Prompt shipment on standard Machinery. Write for Bulletins on the subject which interests you.

FRASER & CHALMERS OF CANADA

4 PHILLIPS PLACE LIMITED MONTREAL, P.Q.

MORGAN BATTERSEA CLAY GOODS

Muffles, Crucibles, Scorifiers, Cupels, Furnaces, Etc.

Known the world over as best, having certain features which ever commend them to all users of high-class goods.

MORGAN PLUMBAGO CRUCIBLES

For melting Gold, Silver, Copper, Steel and other metals, are of superior quality, have great uniformity and are favorably known for their power of resisting extreme heat without the danger of cracking from sudden changes.

CHLORIDE OF LIME

Needed for the Spring clean up. In drums, barrels, kegs and smaller packages.

WAUGH STOPING DRILLS

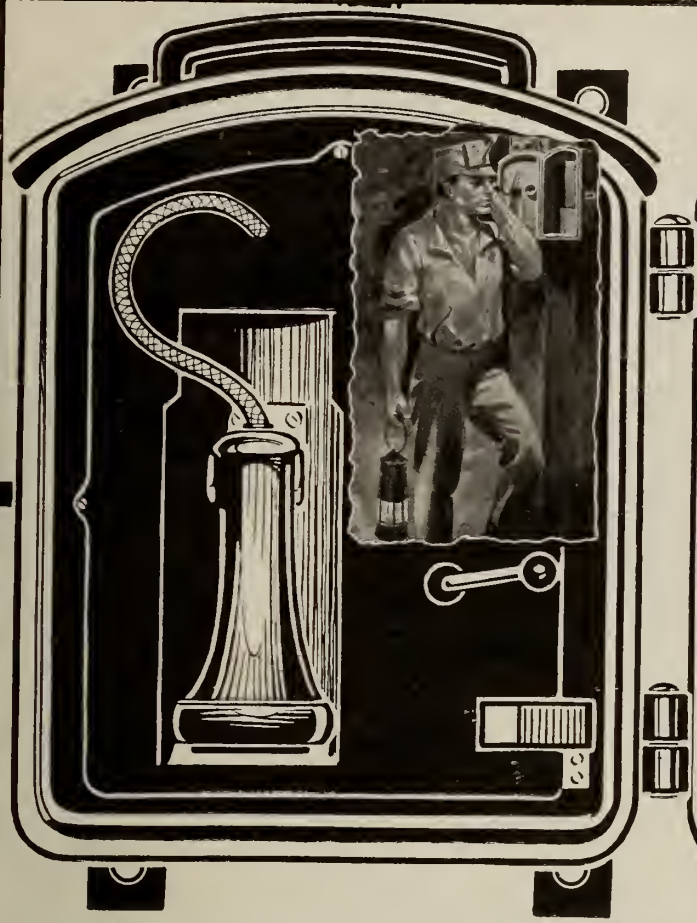
Manufactured by the Denver Rock Drill Manufacturing Co., Denver, Colorado

THE MODEL 16V WAUGH STOPER

is carried in stock by us and sold with the guarantee that it will do more work for you than any other stoper you have or can get. Proved the best by many tests. Write for information and prices.

THE GEORGE TAYLOR HARDWARE CO. LIMITED

NEW LISKEARD (Head Office) COBALT COCHRANE



MINE TELEPHONES

Bring every part of the mine into instant communication.

In emergency, warning can be flashed to every part.

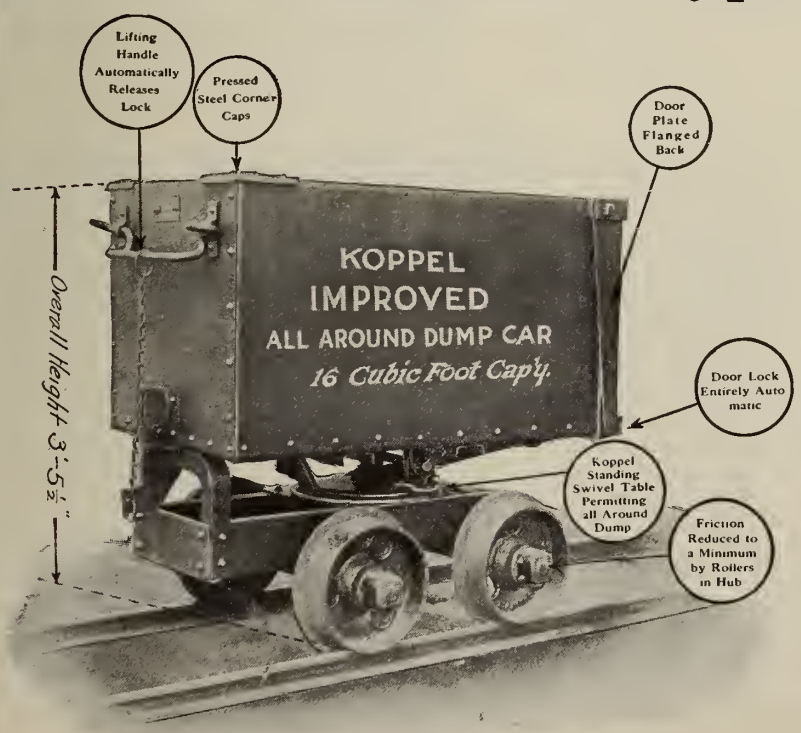
Even under ordinary conditions it is invaluable changing the mine from a number of disjointed departments isolated by distance, to a compact organization working together with the greatest efficiency under the one head.

Our nearest house will gladly send a man to tell you all about Northern Electric Mine Telephones.

Northern Electric Company
LIMITED

Montreal	Winnipeg	Edmonton
Halifax	Regina	Vancouver
Toronto	Calgary	Victoria

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Capy.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

St. John to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 52 King St. E., Toronto, Ont.
583 Main Street, Winnipeg, Man. Canada Life Bldg., Prince William St., St. John, N.B.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

HADFIELDS
LIMITED
SHEFFIELD

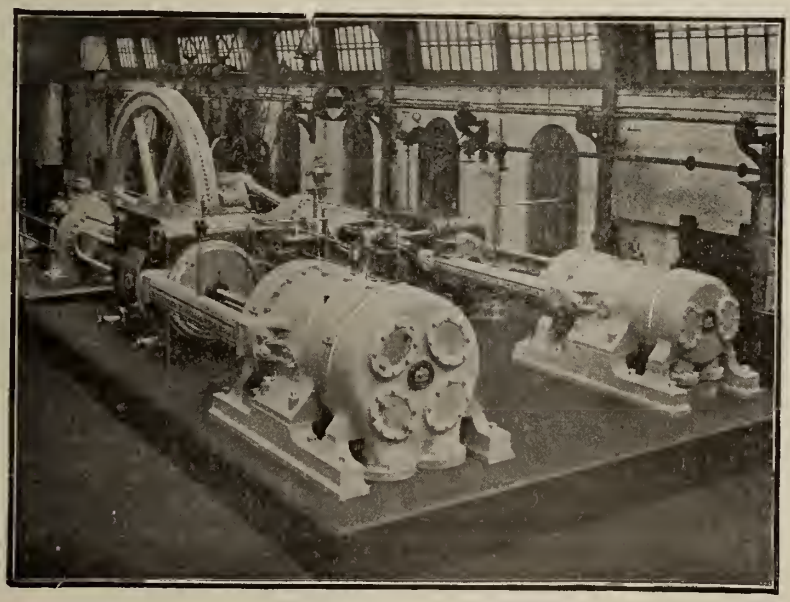
STEEL CASTINGS
of Every Description

Send for Bulletin No. 79

SOLE MAKERS
OF
HADFIELD'S PATENT
"ERA"
MANGANESE STEEL
THE SUPREME METAL
FOR WEARING PARTS

SOLE AGENTS
Montreal **PEACOCK BROTHERS** Vancouver

WALKER BROTHERS (WIGAN)
LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES
With Valves to Recent Patents

THE
"WALKER" COMPRESSOR
is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company
Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

FOR SALE
Steam Hoisting Engines and Pumps

The following machinery has been put out of service by an electric installation and is offered for immediate delivery, f.o.b. cars Stellarton, Nova Scotia.

1 Novelty Iron Works Steam Hoisting Engine. Duplex cylinders, 16″ diameter by 42″ stroke. Geared to 2 cast iron drums 9′ diameter by 56″ wide. Gear ratio 3 to 1, also 6,500′ of 1″ steel cable.

1 I. Matheson and Company's Steam Hoisting Engine, duplex cylinders, 16″ diameter by 30″ stroke. Geared to 2 cast iron drums 9′ diameter by 54″ wide. Gear ratio 2.4 to 1.

1 Jeansville Duplex Triple Expansion Pumping Engine, Steam cylinders 19″, 27″ and 44″ diameter, by 36″ stroke. Water cylinder 9″ diameter, together with jet condenser and condenser pump. Outfit capable of handling 1,000 gallons per minute against 1,800 feet head. Very low prices.

Address
Acadia Coal Company, Limited,
Stellarton, N.S.

ELECTRIC STEEL CASTINGS

Our Welland Plant will be ready to furnish Carbon, Manganese, Alloy Steel Castings and Forging Ingots by the end of May, made by the Electric Furnace Process. This process makes a dependable high-grade Steel and Steel Castings, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars.

THE ELECTRIC STEEL & METALS CO., LIMITED
WELLAND - ONTARIO

Shot
Blocks
Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.
43 Exchange Place — New York

ALSO
Electrolytic Nickel
(99.80% Pure)

WATEROUS STEEL TANKS

For Steel Tanks---Built to Order at a Reasonable Price---Write us

WE BUILD

WASHING TANKS
CYANIDE TANKS
SETTLING TANKS
PRESSURE TANKS
AIR RESERVOIRS
STORAGE BINS

Any Size *Any Style* *Any Number*

We build Steel Tanks and Bins turned out to suit special requirements at a price which is not special.

SEND US YOUR SKETCHES FOR A QUOTATION

The Waterous Engine Works Co.
LIMITED
BRANTFORD - CANADA

LYMANS, Limited
MONTREAL

Headquarters for—

Balances
Crucibles
Crushers
Furnaces
Bone Ash
Borax
C.P. Acids and Chemicals
Etc., Etc.

Assay Supplies
Largest Stock in Canada

Assay Supplies
Largest Stock in Canada

Try a "Cleveland" Stope Drill

If we could make a demonstration for the superintendent and foreman of each different mine running stopes, we know we could convince them of the fact that the "CLEVELAND" is the best Stope Drill made—for we have been successful in so convincing every superintendent for whom we have made a demonstration, and have received his order.

A special demonstration in every mine is out of the question—but why not let us send you one for trial

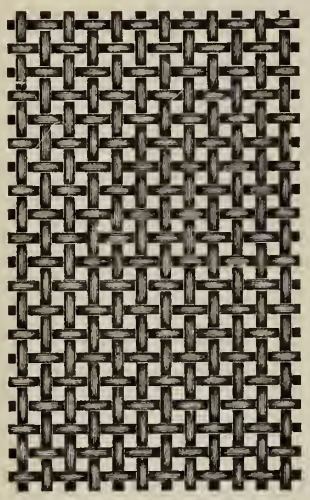
IN YOUR OWN MINE

so you can find out for yourself what it will do.

Write for Bulletin 40A.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street - TORONTO

SCREENS



FOR

All kinds of Mining Work and Cement Mills

Wire Cloth, Square or Oblong Mesh, and Perforated Metals for all kinds of revolving or flat screens.

MANUFACTURED BY

The B. GREENING WIRE CO., Ltd.

HAMILTON, ONT. MONTREAL, QUE.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 14" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: **NEW GLASGOW, NOVA SCOTIA**

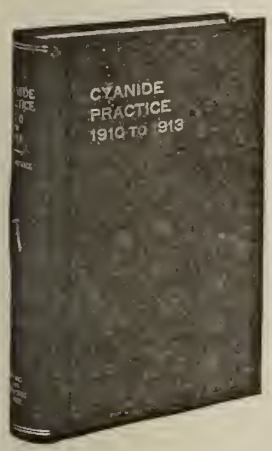
NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

CYANIDE PRACTICE
1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.

140 illustrations

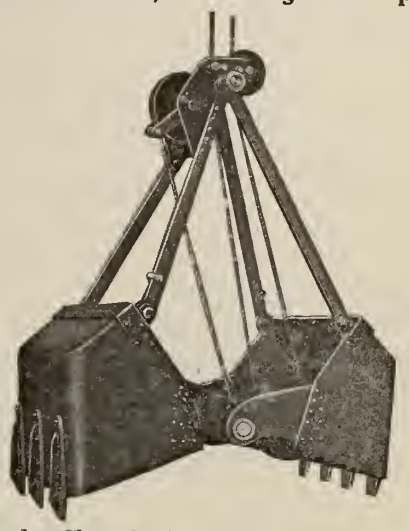
Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings: Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

"BEATTY HOISTS"
Clamshells, Derricks, Centrifugal Pumps, Etc.



If you need a Clamshell for any purpose, we can furnish it quickly—most likely we have it in stock.

Can also supply any standard size Hoist, with single, double or triple drums—FROM STOCK.

Let us know your requirements—we'll do the rest

M. BEATTY & SONS, LIMITED
WELLAND, - ONTARIO

SUPPORT HOME INDUSTRIES
THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records

Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

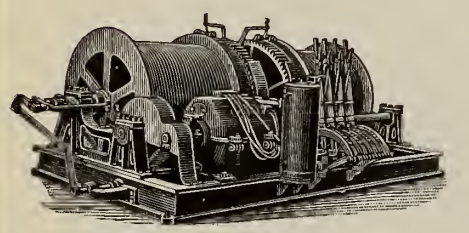
THE CANADA METAL CO., LIMITED
HEAD OFFICE AND FACTORY **TORONTO** BRANCH FACTORIES **WINNIPEG** AND **MONTREAL**

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

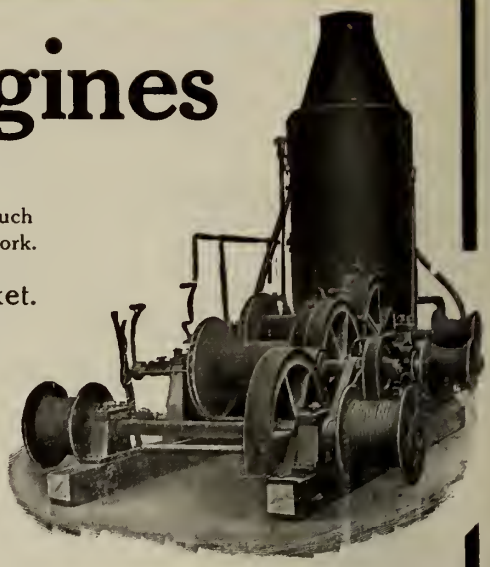


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

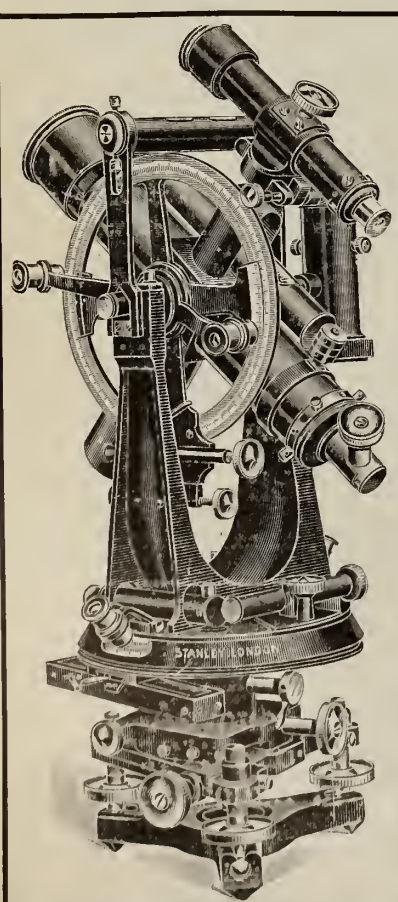
Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL



Stanley's Dunbar-Scott Auxiliary Top and Side Telescope. Requires no correction for eccentricity.

Trade
STANLEY
Mark

The largest manufacturers of

SURVEYING and DRAWING INSTRUMENTS in the world.

DRAWING OFFICE STATIONERY of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our "K 35" Catalogue (post and duty free) and compare our prices with those of other first-class makers.

W. F. Stanley & Co., Limited

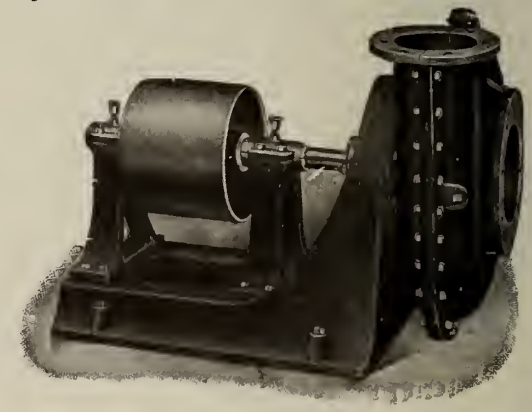
Export Dept.: Great Turnstile, High Holborn, W.C.

Head Offices and Showrooms:

286, High Holborn, London, W.C., Eng.

What more can be desired for the use of your money than first-class workmanship and material?

This is what you get when you buy from



The Smart Turner Machine Co.

LIMITED

Hamilton, Canada

Printing!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets.
Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

GOLD

Its Geological Occurrence and Geographical Distribution

By MALCOLM MACLAREN

This is an excellent treatise, carefully written by a well-known authority on gold deposits.

It is the most comprehensive work on the subject, and contains authentic descriptions of gold deposits in all parts of the world.

Accuracy and brevity are notable features.

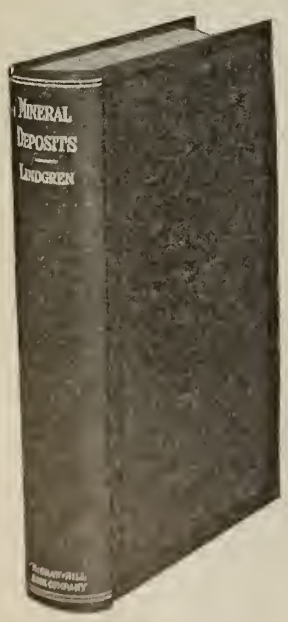
The volume is well printed and contains 278 illustrations.

The price is $7.50.

Book Department, Canadian Mining Journal

44-46 Lombard Street, Toronto

Lindgren— MINERAL DEPOSITS



For Sale by the

Canadian Mining Journal

44-46 Lombard St. Toronto

By WALDEMAR LINDGREN, Professor of Economic Geology, in in charge of the Department of Geology, Massachusetts Institute of Technology; Geologist, United States Geological Survey.

883 *pages, 6x9,* 257 *illustrations,* $5.00 (21s) *net, postpaid*

For many years Mr. Lindgren has been Geologist of the United States. Geological Survey.

In this time he has come to be generally recognized as the leading authority on ore deposits.

The publication of this work on "Mineral Deposits" has been anticipated throughout the world.

It is the first book to attempt to cover within reasonable space both metallic and non-metallic minerals, except coal and oil.

—CONTENTS—

Introduction.
Deposition of Minerals.
The Flow of Underground Waters.
The Composition of Underground Waters.
The Chemical Work of Underground Waters.
The Origin of Underground Water and its Dissolved Substances.
The Spring Deposits at the Surface.
Relations of Mineral Deposits to Mineral Springs.
Folding and Faulting.
Openings in Rocks.
Form, Structure and Texture of Mineral Deposits.
Ore Shoots.
Classification of Mineral Deposits.
Deposits Formed by Mechanical Processes of Transportation and Concentration; Detrital Deposits.
Deposits Formed by Chemical Processes of Concentration in Bodies of Surface Waters.
Deposits Formed by Evaporation of Bodies of Surface Waters.
Deposits Formed by Processes of Rock Decay and Weathering.
Deposits Formed by Concentration of Substances Contained in the Surrounding Rocks by Means of Circulating Waters.
Deposits Formed by Regional Metamorphism Formed by Zeditisation.
Deposits of Native Copper in Basic Lavas.
Lead and Zinc Deposits in Sedimentary Rocks in their Genetic Connection with Igneous Rocks.
Deposits Formed Near the Surface by Ascending Thermal Waters and in Genetic Connection with Igneous Rocks.
Deposits Formed at Intermediate Depths by Ascending Thermal Waters and in Genetic Connection with Intrusive Rocks.
Veins and Replacement Deposits Formed by Hot Ascending Waters at High Temperature and Pressure and in Genetic Connection with Intrusive Rocks.
Deposits Formed by Processes of Igneous Metamorphism.
Mineral Deposits of Pegmatite Dikes.
Mineral Deposits Formed by Concentration in Molted Magmas.
Metamorphosed Deposits.
Oxidation of Metallic Ores.
Calculation of Analysis and Representation by Diagrams

MINE RAILS

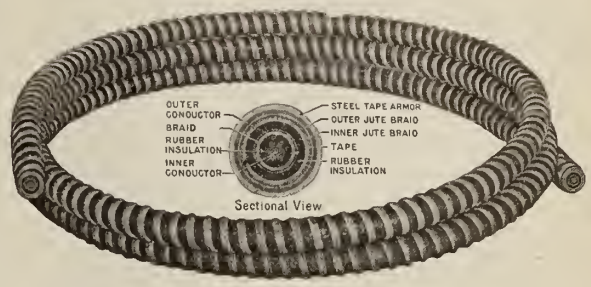
12 to 45 Pounds

PROMPT SERVICE.

H. A. DRURY CO.

LIMITED

MONTREAL and TORONTO



Sectional View

When You Buy

your supply of mining machine cable remember that the greatest economy lies in durability and reliability not in low first cost.

STANDARD

"Wearproof" Mining Machine Cable

is not made for mere price competition but to give long and satisfactory service, as will be apparent from an examination of its construction illustrated above.

For samples and prices write our nearest office.

Standard Underground Cable Co. of Canada, Limited

Hamilton, Ont.

Montreal, Que. **Winnipeg, Man.**
Boston, Mass. **Seattle, Wash.**

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade managanese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

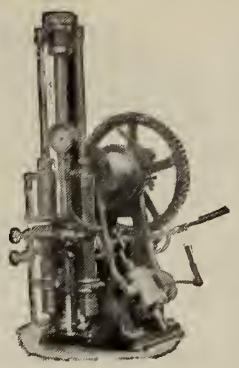
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

CHAIN - BLOCKS ALL SHIPPED THE DAY ORDER IS RECEIVED.

THE HERBERT MORRIS CRANE & HOIST CO., LIMITED,

EMPRESS WORKS, PETER STREET, TORONTO, ONT.

BRANCH OFFICE, CORISTINE BLDG. MONTREAL. QUE,

POSITION WANTED

As superintendent or foreman, by one who has had wide experience in Mechanical Construction, Draughting, Designing and Erecting of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc. References. Will accept small salary until value of services is demonstrated.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

BOOKS

Make use of the experience of others by reading the best technical books.

A good library will help you.

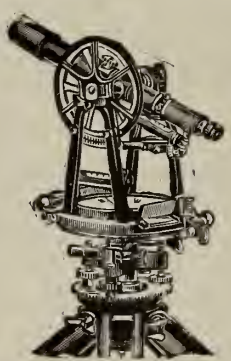
BOOK DEPARTMENT
CANADIAN MINING JOURNAL
44-46 Lombard Street, Toronto

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.



Berger TRANSITS AND LEVELS

Latest designs in Instruments for Underground Surveying for all classes of work. Complete Catalog fully describing and illustrating these instruments, with **a large Manual giving full and concise directions** in the **care, use** and **adjustment** of instruments will be sent on request.

C. L. Berger & Sons, Boston, Mass., U.S.A.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

—SEND FOR CATALOGUE—

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

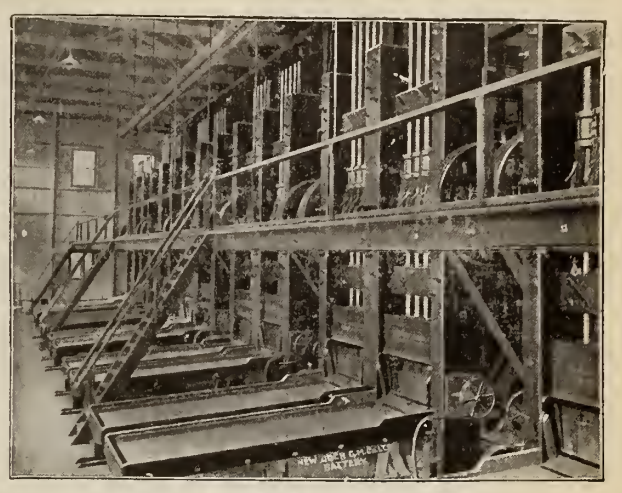
"KRUPP"

MINING-MACHINERY

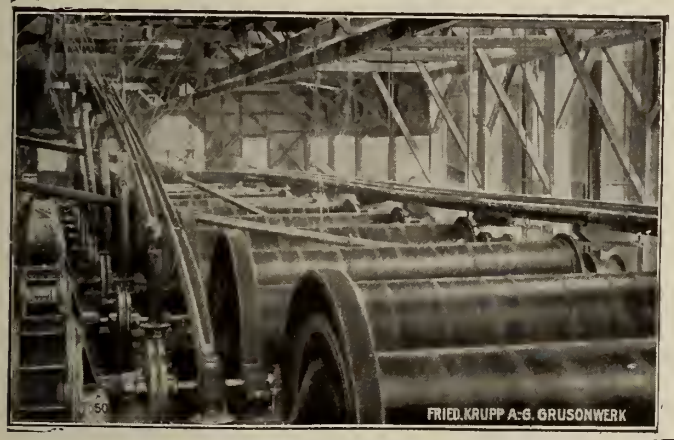
Ore and Rock Breakers, Rolls, Stamps, Shoes and Dies of Special Krupp Steel, Krupp Ball Mills for Dry and Wet Crushing Ores, Chilian Mills (Edge Runners).

TUBE MILLS FOR WET GRINDING

Concentration-Amalgamation-and Cyanide-Plants.



PORTION OF A STAMP MILL FOR GOLD ORES



WET GRINDING TUBE MILLS.

ULLRICH'S Patent Electro magnetic Dry and Wet Separator for strongly and feebly Magnetic Ores.

COMPLETE INSTALLATIONS

for the

TREATMENT of ORES of every kind

Plants for the Metallurgical Treatment of Ores.

FRIED. KRUPP A.-G. GRUSONWERK

MAGDEBURG (GERMANY)

Canadian Representatives:

JAS. W. PYKE & CO., Limited, 232 St. James St. Montreal

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST — LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

B. K. MORTON & COMPANY

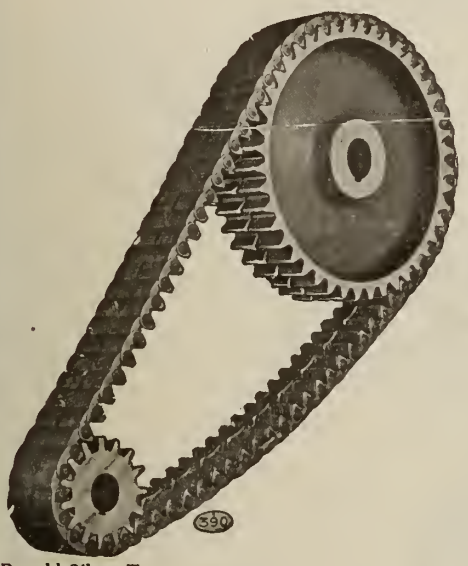
SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD STEEL DRIVING CHAINS

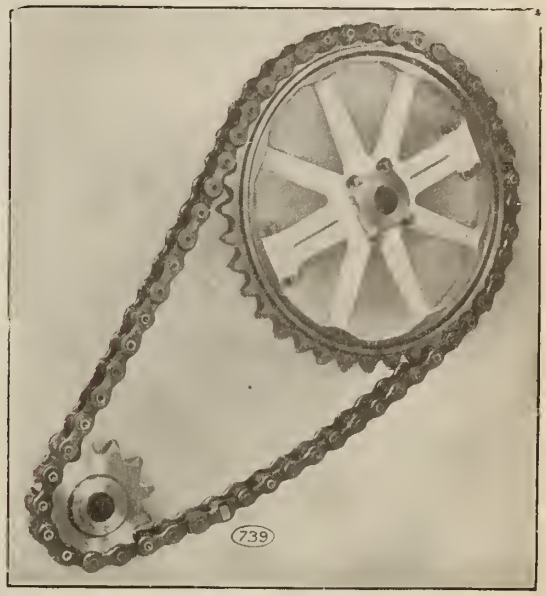
For All Purposes



Renold Silent Type

Save Power, Space and not affected by Heat, Cold or Moisture.

Write for Illustrated Catalogue



Renold Roller Type

JONES & GLASSCO (Reg'd) Engineers

Sole Canadian Agents

Branch Office, Toronto

49 Place D'Youville, MONTREAL

A Unit of Essential and Desirable Features Is the Latest Design of JEFFREY LOCOMOTIVES For Use in Metal Mines.

It is not an adaptation of the standard coal mining locomotive but a distinct design to meet iron and copper mining conditions.

Appreciative consideration has been given to short radius curves, narrow drifts, interchangeability between mine and stock pile, track gauges, safety of operator and helper, and electrical troubles due to water, mud and under-motored equipment.

Safety, reliability and accessibility will be found incorporated in this design which is typical of and a result of the JEFFREY policy to meet actual mining conditions and give the mine operator the benefit of the most efficient equipment.

Write for our Mine Locomotive Catalog No. 117.

JEFFREY MANUFACTURING COMPANY

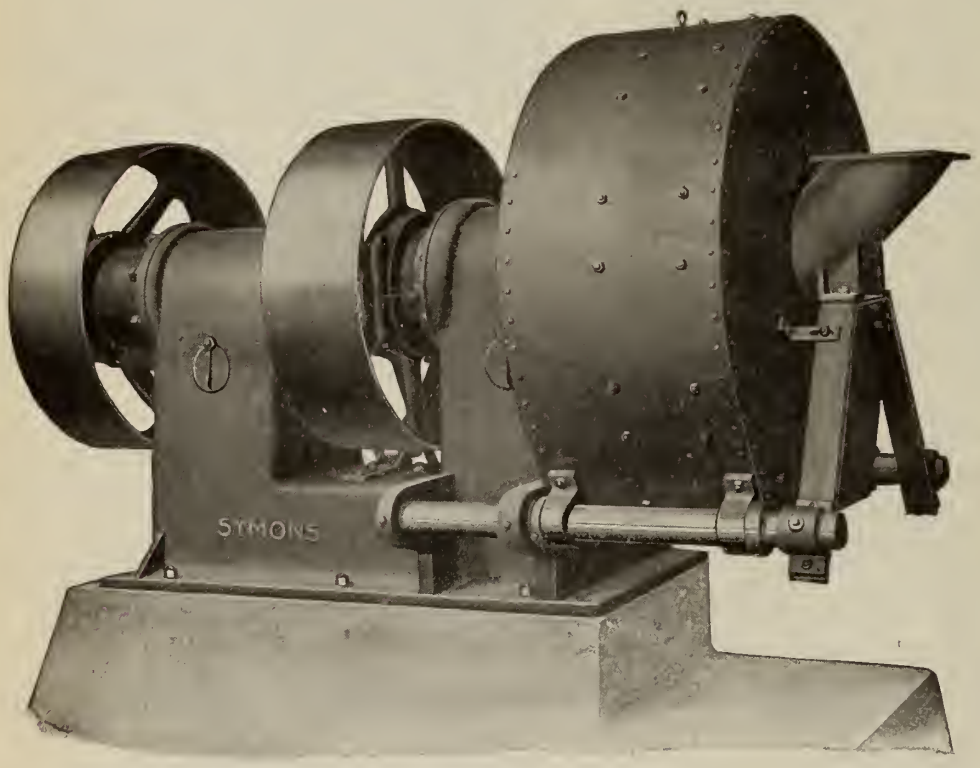
Canadian Main Office and Works: MONTREAL

CAPACITY-STRENGTH-DURABILITY

PUT THE

SYMONS DISC CRUSHER

IN A CLASS BY ITSELF



It is the greatest Re-Crusher on the market

Has no equal for material up to 8 inches in diameter

Will crush 40 tons of 1/4 inch to 1000 tons of 2 1/2 inch stone or ore per 10-hour day.

Let us send you Catalogue No. 46 giving full particulars.

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, May 1, 1914. No. 9

The Canadian Mining Journal

With which is incorporated the
"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

Editorial—	Page
Railways and Mining	289
Conservation of Coal in Canada	289
Western Federation Strike Declared Off	290
The 22nd Annual Meeting of the Mining Society of Nova Scotia	291
The Mining Industry in Relation to the T. & N. O. Ry. By A. A. Cole	294
Annual Report of Nipissing Mines Co. for the Year 1913	295
Gold and Silver Mining in Ontario	298
A Method of Amalgamating in Cyanide Solution	300
The Draining of Kerr Lake	301
Porcupine Crown Mill and Cyanide Plant	303
The Dome Mill	304
Radium and Its Ores. By R. A. A. Johnston	305
The Mond Process of Separating Nickel and Copper. By A. P. Coleman	306
Ore Deposits of the Similkameen District, B.C. By Chas. Camsell	309
Western Federation Calls off Strike in Michigan	312
Book Reviews	315
Personal and General	316
Special Correspondence	318
Markets	324

RAILWAYS AND MINING

In the introductory paragraphs of his report to the Temiskaming and Northern Ontario Railway, Mr. A. A. Cole calls attention to the interdependence of railways and mining and to the great part that both have played in the opening up of new districts.

The financial success of the operation of the Ontario Government Railway is directly attributable to the development of the mineral resources at Cobalt, Porcupine and other points in Northern Ontario. On the other hand, the discovery of these mineral deposits and their successful exploitation is directly attributable to the construction of the railway.

The mines along the railway have furnished a good market for supplies of all kinds. Southern Ontario manufacturers and merchants have profited to no small extent by the development of Northern Ontario mines. Gradually also farms have been cleared in the north country. The pioneer farmers were successful primarily because of the railway service and the market furnished by the mines. The railway still depends largely for its business on the mining industry. Other industries are growing, and as new mineral deposits are opened up, a further stimulus will be given to the development of other resources.

In our April 1 issue we published an article by Mr. E. Jacobs on the same subject, with special reference to British Columbia. In this issue will be found extracts from Mr. Cole's report, showing that what is true of British Columbia and Ontario is true of many other districts. Railway construction and mining are largely responsible for the successful development and permanent settlement of places without number.

CONSERVATION OF COAL IN CANADA

The Commission of Conservation has now ready for distribution a very interesting and useful report on Conservation of Coal, written by Mr. W. J. Dick, M.Sc., mining engineer of the Commission. Mr. Dick urges that more care be taken to prevent waste and offers many suggestions which are worthy of careful consideration. Changes in the form of coal mine leases, utilization of slack and low grade coals, manufacture of coal briquettes and comparison of beehive and by-product ovens are among the subjects dealt with.

The subject has been very carefully studied by Mr. Dick and the book contains a fund of information on Canadian coals and mines.

WESTERN FEDERATION STRIKE DECLARED OFF

The strike of copper miners in Michigan, called on July 22, 1913, to take effect on July 23, has been called off. For several months it has been quite evident that the mines could be operated without using members of the Western Federation. Some of the mines had already more men at work than when the strike was called.

It is no credit to the officers of the Federation that they did not acknowledge their defeat sooner. The prolongation of the strike has been mere waste of the resources of the Federation as well as of the mining companies.

On July 23rd and 24th, finding that many of the mine workers paid no attention to the calling of the strike by the district union, bands of strikers violently drove men from their work and threatened them against returning. Men attempting to go to work and deputy sheriffs, who had been sworn in to guard the various properties, were assaulted. Sixteen men employed by one company were seriously injured. The sheriff found himself unable to cope with the situation and appealed to the Governor of the State for the aid of troops in restoring peace. Governor Ferris sent the National Guard, and a semblance of order was restored. Houghton county and some of the companies engaged men from the Waddell-Mahon Corporation to take charge of a force of about 1,700 deputy sheriffs, who were sworn in to protect life and property.

After the arrival of the troops there was little disorder for a few weeks. Then work was resumed in some of the mines and the strikers resumed their violent tactics in an endeavor to prevent the men from going to work. Gradually, however, the number at work increased in spite of the violence and threats of the strikers. It soon became evident that a majority of the miners were not in sympathy with the strike and that it was destined to failure. Few of the members of the Federation, however, deserted their union, doubtless because of the misleading statements published by their leaders. By instilling false hopes in the minds of the strikers and by paying them a few dollars a week, the leaders succeeded in annoying the companies for several months.

Gradually the men began to realize that while the agitators were profiting, they were themselves gaining nothing by hampering the mining companies and the industry which gives them employment. Their places were being filled by less experienced but more willing workmen. So far as the companies were concerned the strike was over months ago.

Finally, on Easter Sunday, a vote was taken and resulted, as expected, in the defeat of those who wished to continue the strike. The men who return to work will be accepted on the same conditions as before the strike, except that they must first sever their connection with the Western Federation. Before the strike the companies did not discriminate against this organization. Now they do. On the day before the vote was taken there were many strikers at the mine offices asking to be taken back. On Easter Monday there was another rush for places.

Many of the strikers will be given a chance to work again in the Michigan mines. The companies will welcome them back, believing that many of them have acted merely as instruments doing the bidding of socialistic demagogues. The Federation has gained nothing by its alliance with red socialism. The companies have improved their position as a result of the strike, in that they now have a larger number of men than they can find work for. Not for several years has there been such a demand for work at the Michigan copper mines as there is to-day. It should now be possible to greatly increase the efficiency, to increase the production and to retrieve, in part at least, the losses of the period when the Western Federation wasted in Michigan $1,000,000 of labor union funds in an endeavor to cripple an industry which gives steady employment to over 14,000 men and pays in wages over $1,000,000 per month.

The mine managers have stated that none of the new men taken on since the strike began will be dismissed to make places for the strikers who are now clamoring for re-employment. The old employes will, however, be given the preference over new applicants for work. Already many have been taken back. Some will never be re-employed under any conditions. Others will be given work as soon as possible.

In this issue we publish an interesting article on Radium and Its Ores, by R. A. A. Johnston, of the Canadian Geological Survey. The offer by the Ontario Government of a reward to the discoverer of radium ore should stimulate the search for this valuable substance.

Minute diamonds have been found by Mr. R. A. A. Johnston in chromium ore discovered by Mr. D. O'Connor, the well-known Northern Ontario prospector. Mr. O'Connor sent samples of the ore from his claims in Reaume township to the Ontario Bureau of Mines, and it was found to contain chromium and a little platinum. Owing to the similarity of the ore to that of the Tulameen district, B.C., in which Mr. Johnston had found diamonds, Dr. Miller submitted specimens to Mr. Johnston for examination. The discovery of the diamonds resulted. The diamonds are very small and of little value; but the discovery is of interest.

The ore sent in by Mr. O'Connor is chiefly valuable for its chromium content. Concerning the size of the deposit we have as yet no accurate information.

Mr. O'Connor has made many important discoveries in Northern Ontario. His latest promises to result in attracting attention to the possibilities of the country traversed by the National Transcontinental Railway.

THE TWENTY-SECOND ANNUAL MEETING OF THE MINING SOCIETY OF NOVA SCOTIA

The annual meeting of the Mining Society of Nova Scotia held in Sydney occupied the dates 15th and 16th April, and proved successful beyond the expectations of the most sanguine. The Council in making the arrangements for the meeting thought it wise to limit its duration to two days, but the event proved that a three-days' meeting would have been desirable.

The morning session of Tuesday was taken up by business proceedings, those tiresome but apparently inevitable details that waste valuable time, which most persons would rather see devoted to the reading and discussion of papers.

Electric Motors for Mine Service.

In the afternoon a paper was read by Mr. C. H. Wright, of Halifax, on "The design of electric motors for service in mine operations." This paper was avowedly written to evoke discussion, and it was followed by one of the most animated and technically valuable discussions that the meetings of the Society have ever witnessed. The discussion embraced opinions on the relative merits of alternating and direct current for mining service, and the general opinion was that the choice depended largely upon the size of a colliery plant and the distance over which it was necessary to transmit current. Some interesting opinions were expressed on the subject of variable speed motors for ventilation fans, and here, so far as could be gathered, the concensus of opinion was that variations in the quantity of air required for ventilation could be best obtained by an arrangement of doors in the fan-drift, and that there was not much advantage in the complications of a variable speed-motor.

The number of speakers in the discussion and the interest evoked was evidence of how important a part electricity now plays in coal mining plants in Nova Scotia. Mr. Wright is the representative of the Canadian General Electric Company in Nova Scotia, and had to defend manufacturers of electrical machinery in general against the charge that the manufacturers expected too much from colliery engineers in the matter of specification and design of plants to meet certain conditions. The engineers present urged upon manufacturers the necessity of spending a little money in experiment and research to meet existing conditions, rather than to expect purchasers to do this all by themselves. Mr. Wright ably defended the manufacturer, but the contention of the engineer is not without foundation.

Coal Resources.

Mr. McLeish, the statistician of the Department of Mines, showed a number of statistical graphs illustrating the mineral statistics of Canada. Mr. McLeish also exhibited interesting charts compiled from the monograph on the "Coal Resources of the World," issued in connection with the International Geological Congress of recent date. The outstanding impression obtained from these charts is the predominance of the North American continent in bituminous coal resources, and the fact that the bulk of the anthracite coals of the world is in and around the ancient Empire of China. Mr. McLeish is au fait with all figures relating to minerals in Canada and he was required to make his usual explanations with regard to the method of valuation used by the Department in arriving at the amount of wealth represented by the annual mineral yield of the Dominion. Nova Scotians in the audience were a little astonished at the enormous coal resources of Alberta when compared with those of the Maritime Provinces, and also with the rapid increase in production in that Province. The only consolation to Nova Scotians is that their Province contains the quality, although Alberta apparently has the quantity.

Microscopical Study of Coal.

In the evening a paper was read by Mr. A. J. Tonge, the mining engineer of the Dominion Coal Company, on "Coal, as seen under the microscope." The paper was introductory to a number of microphoto slides, obtained from the paleo-botanical laboratory of Mr. James Lomax, of Wigan, Lancashire, showing magnified sections of representative British coals, colored by hand to represent without exaggeration the actual appearance under the microscope. Mr. Tonge related some of the recent advances made in the microscopical study of coal, and the unique position occupied in this connection by Mr. Lomax, whose work has recently attracted widespread interest in mining circles. The slides were one of the outstanding features of the meeting, and were a revelation to all present of the tremendous possibilities of a science that is but in its infancy. In several of the slides layers of what are supposed to be leaf tissues were distinctly observable, and it has been suggested that these layers represented the successive seasons of the carboniferous forest, and that if it were possible to make a complete section of a coal seam, some idea of the number of seasons that were occupied in the making of the coal seam might be obtained, and an approximation arrived at as to the length of time represented. On some of the spore-cases which were visible in the slides it was explained that certain characteristic and ornamental pittings were to be seen, and it was hoped that by study under high magnification it might be possible to identify some of these "pittings" and perhaps aid in the correlation of seams by their identification and classification. Some of the vistas which are opening up to the scientific imagination through the microscopical study of coal sections lead to conclusions that savour of unbridled theorizing, but these same conclusions may seem commonplace to the next generation.

A few slides of Cape Breton coals were projected on to the screen without much magnification, and among these slides was one which showed a complete spore-case with the spores intact, a specimen stated by Mr. Lomax to be extremely rare, as it is only by chance that such a specimen should occur in the small piece of coal which is selected for the making of a section.

Mr. Tonge's paper was not followed by discussion, really because the hour was late, and other papers were to follow, but also because the feeling of the meeting was one of wonder at the beauty and novelty of the slides, and most of those present felt they required time to assimilate an entirely new idea and point of view.

Accidents in Mines.

Following Mr. Tonge's paper, was one on "Accidents in Mines," by Hon. Robert Drummond, the editor of

the Maritime Mining Record. Mr. Drummond deplored the recent tendency to increase shown by fatalities in Nova Scotian collieries, to reduce which he advocated more stringent enforcement of the existing mining laws. Mr. Drummond's paper was not discussed at length, as it was felt that the strictures it contained were only too deserved so far as the increase in accidents is concerned.

First-Aid Work.

After hearing Mr. Drummond's paper, the meeting removed to the Sydney Casino and witnessed several cinematograph reels lent by the U. S. Bureau of Mines, showing first-aid work, and other matters connected with the "Safety First" movement. The film showing the effects of a coal-dust explosion in the experimental gallery was most convincing, but the other film which showed men wearing oxygen helmets descending a mine slope immediately after an explosion, the slope meanwhile belching great volumes of thick black smoke, was not only unconvincing, but in the opinion of practical men, undesirable, as teaching the public to expect too much of breathing apparatus, and inculcating the belief that men wearing oxygen helmets can go anywhere and do anything. The possibilities of oxygen breathing apparatus in smoke and fumes was well demonstrated by the film showing men wearing apparatus passing into the smoking experimental gallery, but while not wishing to disparage the work of the U. S. Bureau of Mines, who were so kind as to lend these films to the Mining Society without charge, it was the general opinion of the mine managers who saw them that the film above referred to was a little theatrical and misleading.

After the Bureau of Mines films, a number of films were shown illustrating the application of the cinematograph to scientific investigation of motion, these examples being chosen in connection with a paper prepared for the meeting by Mr. Alex. Theurkauf, chief draftsmen of the Dominion Steel Company, on "Cinematrics as an aid to Science."

This finished the proceedings of the first day, and the meeting adjourned at eleven p.m.

Mine Accidents and Their Causes.

On Wednesday morning the reading of papers connected with questions of mine safety were continued. A paper was read, prepared by Mr. John Casey, the manager of Dominion No. 4 colliery, on "Mine Accidents and Their Causes." Mr. Casey referred to the large number of accidents arising from falls of coal, of roof and sides, to the necessity for systematic timbering, and to the widespread propensity of the miner to "take a chance" and to neglect spragging and timbering, oftentimes leading to his death. Mr. Casey, like Mr. Drummond, advocated more stringent enforcement of the existing regulations, but was afraid that no legislation would cure wilful, or unthinking personal negligence.

Safety First.

Mr. C. J. Coll followed with a paper on "Safety First," in which he traced the historical development of the movement, and pleaded for its extension into the mines of Nova Scotia. It has been the proud boast of Nova Scotia that safety has always been a first consideration in its coal mines, and up till now the Province has not felt the need of bringing about the state of auto-suggestion which the phrase "Safety first" is creating among mine workers in the United States to-day. The obsession of individualism characteristic of the last industrial generation in the States, combined with the tremendous influx of an ignorant and docile labor supply from poverty-stricken districts of Europe did give rise to a cynical disregard of human life and ordinary ethics that has rendered necessary some such appeal to the psychology of the individual worker and his master as the slogan "Safety first," but the Nova Scotian is diffident about the matter, because he thinks he always did value human life. Possibly, however, the large number of foreign laborers now in Nova Scotia may render it necessary to take mental stock of our position and see if we also are not in danger of drifting into indifference. The general burden of the papers read before the Nova Scotia Mining Society at this meeting would lead one to believe, however, that the Province is fully awake to its responsibilities in this connection.

The Working of Coal Seams.

Mr. Herd, the assistant mining engineer of the Dominion Coal Company, read a paper on "The working of two coal seams which closely approached each other, by the long-wall method." This paper was of a very practical nature and described an actual case which had come under the writer's notice of the working of two coal seams, by the long-wall method, where the coal seams closely approached each other. The paper was an excellent illustration that hard and fast rules regarding the working of the upper seam first, or the lower seam first, could not be laid down, but were influenced by many local factors. Two other papers were prepared on mining by the long-wall method, but the time would not allow of their being read. One paper was by Mr. J. F. K. Brown, president of the Mining Engineering and Supply Company, of Sydney, who described the possibilities of the long-wall method of mining with the employment of face conveyors and coal-cutters, illustrated with actual statistics from the author's own experience. The other long-wall paper was prepared by Mr. John Johnson, of Sydney Mines, to describe the "Working of the Jubilee Pit of the Nova Scotia Steel & Coal Co. by the Long-wall Method." Mr. Johnson was ill and could not attend, and his paper was taken as read owing to lack of time.

Topographical Surveys.

In the afternoon session of Wednesday, Mr. Boyd, of the Dominion Department of Mines, showed a series of slides illustrating the methods used and the difficulties encountered in making topographical surveys of Canada. It is gratifying to know that such exact methods and the results are insisted upon in this important work, and the audience were particularly impressed with the photographs showing the difficulties of surveying mountainous country. Particular interest was attached to the detailed large scale maps which the Department is preparing for the use of engineers in portions of the Dominion where mining operations are extensive. The use of contours was strikingly illustrated by pictures of Turtle Mountain compared with a cardboard model made on the field from contours and sections taken off the published map. A map of the Dominion was shown marked with the districts already surveyed in less or greater detail by the Survey, and although the work done is but small in comparison with the vast area of the Dominion, it has been carried out in the most important districts, and from the information given by Mr. Boyd has been done with a thoroughness that very few persons properly appreciate.

Transportation.

Mr. C. M. Odell, the resident engineer of the Dominion Coal Company, read a paper entitled "Transporta-

tion,'' which transported his audience, and for which he himself should be transported. Mr. Odell's paper was unique, like himself, and bids fair to become a classic in this vicinity. The paper contended that nations rose and fell as their means of transportation were good or bad, and although its reading evoked continuous laughter, the basic importance of transportation could not have been more forcibly propounded.

The Department of Mines.

Mr. Odell's jeu d'esprit was followed by a talk from the Deputy Minister of Mines, Mr. Brock, who explained the work and constitution of the Mines Department at Ottawa, and showed a number of slides illustrative of the work of the Geological Survey in the field and office, of the Victoria Museum at Ottawa, and of some of the remarkable fossil remains found in the Northwest.

''De Re Metallica.''

Your correspondent called the attention of the meeting to Hoover's translation of the ''De Re Metallica'' of Georgius Agricola, and showed lantern slides of some of the curious woodcuts that the translation contains. Dr. Adams, of McGill University, referred to the benefit that Mr. Hoover and his wife had conferred upon the mining world by this translation, and mentioned that the copies of this unique reproduction had cost to produce about $15.00 each, but had been sold for $5.00.

Distillation of Coal.

The concluding paper of the meeting was read by Mr. F. J. Lucas, superintendent of the Coke Ovens of the Dominon Iron & Steel Co., and treated of ''The Distillation of Coal.'' Mr. Lucas' paper was largely a plea for the more complete extraction and utilization of the by-products of coal, and enlarged upon the really small percentage of coal consumed in the raising of power that represented the ultimate efficiency realized. A lengthy discussion followed this paper, and there was complete unanimity in the opinion that present methods of using coal are wasteful in the extreme.

The proceedings closed with the annual banquet on Wednesday evening.

C. M. I. Officers Propose Affiliation With N. S. M. S.

A deputation from the Canadian Mining Institute attended as the guests of the Nova Scotia Mining Society, consisting of the president, Mr. Lindsey, Dean Adams, of McGill University, and Mr. Mortimer Lamb, the secretary. The delegation came for the purpose of laying before the Mining Society proposals for affiliation with the C. M. I. The Council were empowered to deal with these proposals and report to the members. There seems a good probability of a conclusion being reached in this matter which will be satisfactory to both societies. The presence of the C. M. I. delegation, together with that of Messrs. Brock, Boyd, and McLeish, of the Mines Department, added greatly to the success of the meeting, and was a source of gratification to those who had arranged the preliminaries.

Features of the Meeting.

A striking feature of the meeting was the extensive use made of lantern slides, which, thanks to the president, Mr. Sexton, were successfully handled.

The number and excellence of the papers read, the really worth-while discussion that followed them, the large attendance of local men actively engaged in the technical direction of mines, and the presence of prominent mining men from outside the Province, together with the excellent leadership of President Sexton—who, by the way, comes out of the twenty-second meeting of the Society with an enhanced reputation for courtesy, wit and ability—all combined to make the meeting in Sydney more successful than the most sanguine had dared to hope. Great things are expected when the annual meeting comes round again.

REWARD FOR DISCOVERY OF RADIUM IN ONTARIO.

The Ontario Government has presented a bill which provides for the payment out of the Consolidated Revenue Fund of a reward not exceeding $25,000 to the first person proving to the satisfaction of the Lieutenant-Governor in Council that he has discovered radium in the Province of Ontario.

The bill further provides that the Lieutenant-Governor in Council may:

(a) Reserve all radium in the Crown lands of Ontario not staked out, located or sold at the date of the passing hereof, notwithstanding anything contained in the Mining Act of Ontario, the Public Lands Act, or any other Act or regulation; and any such reservation shall be taken to include the right to enter upon such lands whether or not the same may hereafter be staked out, located or sold, and to dig for, work and remove all radium thereon, and to do all acts necessary or incidental thereto; and may rescind such reservation in whole or in part at pleasure;

(b) Make rules and regulations for the exploration of such lands, the working of any deposits of radium found thereon, the treatment of the same, and the production of radium therefrom, and the conservation, sale or use of the radium so produced, and make any such other rules and regulations for conserving and obtaining radium from such lands as may seem proper;

(c) Purchase and acquire on behalf of the Province any radium-bearing lands not the property of the Crown, or any specified interest therein, or the right to work the same for radium, on such terms as he may deem proper, subject to the approval and ratification of the Assembly, and make such rules and regulations for the working of the same, the production of radium therefrom, and the conservation, sale or use of the radium so produced as he may deem proper;

(d) Under the direction of the Minister of Lands, Forests and Mines expend moneys appropriated for any or all such purposes by the Legislature.

THE IRON INDUSTRY.

At the annual meeting of the Canadian Mining Institute in Montreal, March 4, 5 and 6, it was proposed ''That the Canadian Mining Institute, in annual meeting assembled, begs to direct the attention of the Federal Government to the fact that the iron industry of Canada is handicapped by the reason that there has not as yet been found in the country the same extensive deposits of high grade ore as are freely mined in the neighboring Republic, and in Newfoundland and Cuba, which necessitates the importation of 94 per cent. of all the iron ore smelted in Canada. Whereas it is the conviction of the Canadian Mining Institute that such deposits ought, by increased endeavor, to be found. Therefore, we most respectfully request that the Dominion Government will, through its proper channels provide every necessary means for the accomplishment of this most desired end, the realization of which would add more than anything else to the economic wealth of the Dominion.'' The resolution was adopted.

THE MINING INDUSTRY IN RELATION TO THE TEMISKAMING AND NORTHERN ONTARIO RAILWAY

By Arthur A. Cole.

(From the annual report of the Temiskaming & Northern Ontario Railway Commission.)

The fertility of the soils in the clay belt of Northern Ontario is becoming better known every year, but it is not necessary to go back many years to find complete ignorance on this subject among many otherwise well informed people. To these the building of Ontario's Government railway, north from the Canadian Pacific Railway for over 100 miles, to reach the agricultural lands of the clay belt seemed the veriest waste of money.

The possibility of other industries helping out agriculture in building up business for the railway was considered by the promoters of the colonization idea, but with little thought of the importance these industries were soon to assume. The railway was thus started and the wisdom of the decision was soon shown in the large increases in the values of the timber limits being sold by the Ontario Government.

When the railway reached the present site of Cobalt, a new chapter in the history of this enterprise was started by the introduction of the mining industry. The business of the railway due to this industry rapidly assumed prime importance and this position it is likely to hold for many years to come.

The importance of mining was further increased by the discoveries later of the silver districts of Elk Lake, Gowganda, and South Lorrain, and the gold districts of Porcupine and Kirkland Lake.

The following statement of freight revenue on the Temiskaming and Northern Ontario Railway for the years 1911, 1912 and 1913, shows the relative positions of the agricultural, lumbering and mining industries eight, nine, and ten years after the discovery of Cobalt.

Sources of Freight Revenue, T. & N. O. Ry.

	1911			1912			1913	
	Revenue.	Pct.	Tonnage.	Revenue.	Pct.	Tonnage.	Revenue.	Pct.
Agriculture	$69,925.75	6.5	56,325	94,858.31	10	82,092	$111,928.69	12
Lumbering	152,400.97	14	95,753	150,623.20	17	143,660	197,383.23	21
Mining	510,729.74	48.5	247,830	400,821.50	44	328,366	444,499.55	48
Miscellaneous	326,445.81	31	163,342	260,591.59	29	129,978	173,551.65	19
Totals	$1,059,502.27	100	563,250	$906,894.60	100	684,096	$927,363.12	100

(Under the heading of miscellaneous is placed the income from freight for construction and also the through freight for the National Transcontinental Railway.)

In the above statement all business due to the prosecution of each industry is segregated without any consideration of class of commodity comprising the freight handled. Thus at a station whose business is entirely due to the lumbering industry in the vicinity, the whole of the business of that section is credited to the lumbering industry though the freight handled will comprise machinery, foodstuffs, etc., as well as lumber.

In the report for the fiscal year 1913, the Department of Railways and Canals of Canada publishes the following table based on the class of commodity handled by the railways of Canada:

Commodities Carried by the Railways of Canada.

	1907. Pct.	1908. Pct.	1909. Pct.	1910. Pct.	1911. Pct.	1912. Pct.	1913. Pct.
Pruducts of agriculture	16.85	14.91	17.91	17.31	17.17	19.34	16.31
Products of animals	4.37	3.92	4.21	3.71	4.00	3.53	3.01
Products of mines	32.68	35.92	35.81	35.11	35.87	35.18	38.16
Products of forests	18.11	20.49	17.35	17.54	16.57	15.82	15.75
Manufactures	14.11	16.56	11.82	13.44	17.00	18.16	18.68
Merchandise	4.08	3.18	3.58	3.39	3.06	3.03	4.14
Miscellaneous	9.79	11.02	9.32	9.50	6.33	4.94	3.95

An interesting comparison may here be made with figures compiled for the United States Interstate Commerce Commission from whose reports the following table is taken. It shows the freight traffic movement by class of commodity, originating on line of reporting roads in the United States for the fiscal years 1900 and 1906:

Commodities Carried by Railways of the United States.

Class of Commodity.	1900 Tonnage reported as originating on line.	1900 Pct. of aggregate.	1906 Tonnage reported as originating on line.	1906 Pct. of aggregate.
Products of agriculture	53,468,496	10.35	70,201,720	8.56
Products of animals	14,844,837	2.87	19,002,825	2.32
Products of mines	271,602,072	52.59	435,450,476	53.09
Products of forests	59,956,421	11.61	92,187,351	11.24
Manufactures	69,257,145	13.41	121,457,738	14.81
Merchandise	21,974,201	4.26	33,319,615	4.06
Miscellaneous	25,329,045	4.91	48,543,902	5.92
	516,432,217	100.00	820,164,627	100.00

ANNUAL REPORT OF NIPISSING MINES CO., 1913

President's Report.

President E. P. Earle says in part:

The production of silver was 4,552,173 oz., valued at $2,756,612.48, and was approximately the same as in 1912. The gross receipts were $2,804,093.46, and the net receipts $1,645,107.87. The expense of production was 24.09 cents per oz. This is 6.70 cents per oz. more than in 1912. The increased expense was due to the fact that nearly one-half the silver was produced from milling ore, and because of the lower average grade of the ore. The average price received for silver was 60.26 cents per ounce. $1,800,000 was distributed to stockholders during the year. The known ore reserves contain 9,510,000 oz. of silver, about one-half of which is in high grade ore. The surplus is $1,259,060.96. These figures show that the reserves and surplus are at almost the high record point. The mines are in excellent condition, and the high and low grade mills are being operated economically and efficiently. Stockholders are fortunate in having the same able mine and mill management as heretofore.

General Manager's Report.

Mr. R. B. Watson, general manager, in his report to Mr. David Fasken, president of the operating company, says in part:

Shipments in 1913 were as follows—

	Dry Tons.	Fine Oz. Silver.	Net Value.
Silver bullion	224.7970	6,530,871.31	$3,894,123.35
Cobalt residue	1,569.2195	57,380.74	62,484.44
By-products and claims paid	166.3500	50,327.29	29,824.05
Bullion from ore milled by Nova Scotia Co.	.3245	9,467.08	5,059.12
Total shipments	1,960.6910	6,648,046.42	$3,991,490.96
Less Custom ore purchased	632.0660	1,803,877.01	1.070,784.69
Shipments of Nipissing product	1,328.6250	4,844,169.41	$2,920,706.27

The production of individual veins in 1913 was as follows:

	Silver Oz. in High Grade Ore.	Silver Oz. in Mill Rock.	Total Silver Oz.
Vein 8	1,091	.....	1,091
Shaft 63 and Little Silver	293,435	192,963	486,398
Shaft 73:—			
Veins 64, 73, 80, and 100	2,147,515	1,767,828	3,915,343
Vein 96	.....	20,051	20,051
Vein 122	104,677	4,367	109,044
Vein 128	6,003	.....	6,003
H 2, 5 and 35	14,243	.....	14,243
	2,566,964	1,985,209	4,552,173

The reduction works for high grade ore treated 1,200 tons of Nipissing ore, averaging 2,501 oz. per ton and 632 tons of custom ores averaging 2,854 oz. per ton. The precipitate from the low grade mill was also sent to the high grade plant for melting and refining. Total shipments of bullion during the year amounted to 6,530,871 fine oz. The residue from the high grade mill carries 20 to 40 oz. of silver, 8 to 10 per cent. cobalt, 4 to 6 per cent. nickel and 30 to 40 per cent. arsenic. This is sold to the manufacturers of cobalt products and during the year shipments of 1,659 tons were made, which netted the company $62,484. The only new construction during the year consists of a baghouse for the fumes from the furnaces and retorts. A great deal of research work has been carried on with the object of improving the method for treating high grade ore and concentrate produced in the Cobalt district. By applying the principles successfully used in the reduction of low grade ore, it is hoped that a method will be worked out whereby the higher grade ore can be treated to advantage by cyanide only.

The record of the low grade mill for 1913 is as follows:

	Tons.	Assay Oz.	Silver Oz.
Ore treated	77,133	27.182	2,096,611
By-products treated	107		54,383
Total milled	77,240		2,150,994
Bullion recovered from above			1,985,209

From the start of the mill, November 11, 1913, the actual recovery has been 91.85 per cent. All ore going to the mill is weighed on a registering beam scale and the content of the ore is based on this weight and on an automatic sample of the 200 mesh pulp as it enters the cyanide plant. Two features made possible the above extraction on these complex ores, which have heretofore resisted successful treatment by cyanide alone. One is the desulphurizing process originated at Nipissing, whereby the fine pulp is subjected to contact with metallic aluminum in a caustic soda solution. This treatment breaks up most of the refractory silver combinations and reduces the silver to the metallic state, so that it goes into solution easily in the subsequent treatment by cyanide. The other feature is the use of aluminum dust for precipitation instead of zinc dust. The resulting precipitate runs over 90 per cent. silver and is melted down into commercial bars 996 fine or better.

The consumption of supplies at the low grade mill was as follows:

	Lb.	Lb. Per Ton.	Cost Per Lb.	Total Cost Per Ton Ore.
Cyanide	400,722	5.190	$.1500	$.7785
Caustic soda	246,880	3.200	.0214	.0684
Lime	512,595	6.640	.0040	.0266
Aluminum dust	43,911	.568	.3373	.1917
Aluminum plates	20,731	.268	.2438	.0654
Aluminum ingots	74,483	.964	.2207	.2128
Flint pebbles	505,170	6.540	.0098	.0646
Ore pebbles	239,500	3.100	....	....
Coal for heating	2,329,250	30.160	.0029	.0881
Power, K. W. H.	3,983,000	51,570	.0115	.5933
				$2,0894

Forty stamps ran 316.82 days or 86.80 per cent. of possible running time. Tons crushed 77,240; crushed per stamp per day 6.09 tons.

The treatment costs, including transportation, picking plant, low grade mill and construction, based on 77,240 tons milled, were as follows:

	Total Cost.	Cost Per Ton.
Crushing at mine	$12,573.51	$.163
Aerial tramway	7,730.43	.100
Surface tramways	9,070.80	.117
Picking plant	16,782.42	.217
Crushing	6,267.72	.081
Battery	20,597.76	.267
Tube mills and classifiers	42,262.52	.547
Slime collecting	34,579.65	.448
Intermediate filtering	9,843.18	.127
Treatment	78,874.29	1.021
Filtering and discharging	14,327.73	.186
Clarifying and precipitation	23,279.55	.301
Refining	9,830.52	.127
Heating	8,745.58	.113
Water supply	2,361.43	.031
Construction	22,071.71	.286
	$319,198.80	$4.132

Surface Prospecting.—Prospecting by cleaning off the surface of the rock with a hydraulic jet was continued in 1913; work began on May 3rd and stopped December 6th; the area cleared was 54.69 acres, the average depth of over-burden being 3.9 ft. Operations are carried on with the aid of a searchlight at night; 125 different set-ups were made, 21,376 ft. of 16 in. pipe was taken up and 25,716 ft. laid down. The average pressure of water at the nozzle was 117 lb. While

no veins of great importance were found, the work exposed numerous stringers and some promising fissures which will be explored further. The ground draining into Cobalt Lake has been about finished and the pump will be moved to Peterson Lake for the coming season's work. A diamond drill was put to work in the diabase area of R. L. 408. Six holes aggregating 2,239 ft. were drilled without favorable results.

Development.—The footage of underground development and exploration in 1913 was about the same as in the previous year, amounting to 13,664 ft., compared with 13,020 ft. in 1912. Nearly three times as much stoping, however, was done in 1913 as in the previous year, the cubic yards stoped being 44,017, compared with $15,764. The broken ore in the stopes ready for hoisting on December 31st was 65,393 tons. During 1913 over 86 per cent. of the silver came from the town side of the property, that is, from shafts Nos. 73, 80 and 64; the production from the territory on the east side of the lake was comparatively unimportant.

Vein 8 was opened up on the 100 ft. level, a raise was put through to surface and some crosscutting done. The results were not favorable. The vein will yield some mill ore but very little high grade.

Shaft 63.—From this shaft 1,756 ft. of exploration hydraulic prospecting were developed and are ready for stoping.

Vein 122.—Some additional exploration work was done from this vein in the area to north and north-east. The results were not encouraging and work is now restricted to taking out what little ore remains unbroken. The broken ore in the stopes is now going to the mill; the low grade ore is exceptionally good.

Shaft 73.—More than half of the total underground work on the property was done at shaft 73 and the results of development here have been very gratifying. The fourth level was opened up at a depth of 324 ft. below the collar of the main shaft; at this level the main vein is mostly in the Keewatin and is low grade. There is a wedge of good ore on the main vein between the third and fourth levels down to the contact. The most notable development of the year was not on the main vein, but on the various cross veins of which there are a dozen. These branch off from the main vein on the south side and will doubtless continue to the contact. Several of them have been recently found on the fourth level, where they occur in the conglomerate, so that we are assured of a good production from these branches between the third and fourth levels. Several veins, which promise well, have been encoun-

A View Across the South End of Cobalt Lake from the Nipissing Property

was done under Little Silver Hill and at the south end of Cobalt Lake. No veins of importance were found, but the shoot of ore on the Little Silver vein opened up satisfactorily and produced some high grade and considerable low grade ore. Nothing of importance was produced by the old veins, 63, 108 and 148, but there remain some good pillars of ore around the shaft.

Vein 86.—Sinking continued in this shaft and a new level was driven at a depth of 176 ft. The vein on this level is poor, but another vein which promises better has recently been cut about 45 ft. to the east. On the 60 ft. level there is a small vein of fair ore for 140 ft. This shaft will produce quite a tonnage of mill rock.

Shaft 150.—A large amount of prospecting was done in the conglomerate area east of Cart lake. From the 209 ft. and 309 ft. levels of shaft 150, crosscuts were run in various directions and several veins were drifted on, but none of this work yielded any ore.

Vein 92.—The open cut on this vein was pumped out and from the bottom some small veins found by the tered in the east crosscut on the fourth level, but whether they are new veins or extensions of the side veins has not yet been proved. The ore reserves, at shaft 73, consist of 2,435,000 oz. in high grade ore and 1,209,000 oz. in mill rock. The broken ore in the stopes amounts to 33,000 tons.

Shaft 80.—Work on No. 80 and No. 100 veins consisted mostly of stoping; the ore bodies exceeded expectations and there is now a large reserve of broken ore in the stopes. These veins have been fully developed and there is little chance of getting more ore than is now in sight. The developed ore in these two veins amounts to 2,218,000 oz.

Shaft 64.—It was not necessary to stope any ore from vein 64, so the only yield from that part of the property in 1913 came from a new vein found in a crosscut connecting the third levels of 73 and 64. This vein promises to be an important discovery; the ore shoot already shows a length of 200 ft., with good ore in the east face. Sinking was continued in the main shaft,

which reached the depth of 878 ft. on February 16, 1914. Crosscuts were driven to the vein at depths of 440 ft. and 650 ft. The vein in these crosscuts is soft and decomposed and shows little change from the condition on the third level, so no drifting was done. Another crosscut will be driven from the 900 ft. level and some development will be done on the vein.

The ore reserves, December 31, 1913, of developed and partly developed ore were as follows:

Vein No.	High Grade Ore. Tons.	Oz.	Mill Rock. Tons.	Assay.	Oz.
73	1,271.6	2,434,962	60,426	20.0	1,208,520
80	335.9	784,250	17,332	25.0	433,300
100	292.5	689,650	12,418	25.0	310,450
63	104.4	300,450	4,134	21.6	89,110
122	....	.....	1,894	25.0	47,350
64	459.9	464,323	7,882	20.0	157,640
	2,463.3	4,673,635	104,086		2,246,370
Dumps			108,094	24.0	2,590,009
			212,180		4,836,379

	Tons.	Assay Oz.	Oz.
High grade ore	2,464	1,897.0	4,673,635
Mill rock	212,180	22.8	4,836,379
Total	214,644		9,510,014

Summary of Results.—The mine produced 4,552,173 oz. of silver during 1913 at an expense of 24.09 cents per oz.; the price received per oz. was 60.261 cents. The difference between the value of the silver produced and the expense of production amounted to $1,660,271 and the dividends declared were $1,830,000.

The Nipissing Company has now entered the second stage of its career. Before 1913 practically all the receipts came from the high grade ore alone; with a number of small picking plants at the principal shafts, the production could be increased at will, as the rich ore only was sorted out and the mill ore thrown on the dump. When the low grade mill went into operation at the end of 1912, the small picking plants were shut down; now the mixture of high and low grade ore just as it is broken down in the mine, is sent to one central picking plant where the rich ore is sorted out and the balance goes to the low grade mill for treatment. The high grade ore is not only less in quantity than formerly but its production is limited by the capacity of the low grade mill which must handle all the ore which goes through the picking plant.

While mining the wide, rich veins near the surface, the company was enabled to turn out a large production at small cost; as greater depth is obtained the veins generally split up into stringers; this results in much wider stopes and a lower average grade of ore.

In 1912 the yield was 4,688,000 oz.—practically all from high grade ore. Although the mine produced almost the same amount of silver last year, two and a half million ounces came from the rich ore sorted out, and two million ounces from mill rock. The total cost of production is therefore increased by the cost of treating the low grade rock and this accounts for the increase from 17.39 cents per oz. in 1912 to 24.09 cents in 1913.

The results obtained at the new low grade plant are very gratifying to the management; the company is now fully equipped to treat all grades of its ore with resulting products of fine bullion and cobalt residue; a considerable custom business is also done in high grade ore; the total shipments of bullion in 1913 from all sources amounted to over six and a half million ounces.

The ore reserves are almost at their highest point, the 215,000 tons of ore ready for treatment being enough to keep the mill running to its present capacity for nearly three years.

While there has been some falling off in the yield of rich ore, the property is still in splendid condition and there is an assurance of good earnings for several years to come.

Diamond Drill, Hollinger Mine

HOLLINGER.

The Hollinger report for the four-week period ending March 25, 1914, shows gross profits of $121,641.23. There was an expenditure during the four weeks of $7,274.71 on plant, $5,071.84 being for mill extension. Total working cost was $61,839.35. The average cost per ton or ore milled was $4.328.

There was hoisted from development work 3,067 tons and from stoping 11,750 tons of ore. The average value of the ore hoisted was $13.30 per ton.

There was also hoisted 1,379 tons of waste rock from development work.

Operations during the month have been under normal conditions. Development in the mine continues to yield satisfactory results. During the period a new ore body 6 ft. wide at $12 per ton was crosscut on the 200 ft. level. Diamond drilling on the 100 ft. level with lateral holes located two new ore bodies of medium grade ore 13 and 31 ft. in width respectively. General development amounted to 766 ft.; diamond drilling 880 ft. The 550 ft. level is being opened up with satisfactory results. Construction has been started on a complete sprinkler system, which should be in operation by August.

GOLD AND SILVER MINING IN NORTHERN ONTARIO

During the past ten years Ontario has made tremendous strides in gold and silver mining. Previous to the discovery of Cobalt silver deposits only one mine, the Silver Islet, had made a large production of silver. Previous to the discovery of the Porcupine gold deposits very few mines had been profitably worked for gold in Ontario.

It is true that there were many gold and silver mines in the Province years before the Cobalt and Porcupine districts were opened up, and it is not unlikely that some of them will prove worthy of reopening. Most of them, however, produced but little and very few were at all profitable. Many were mines in name only. To-day Ontario has many splendid gold and silver mines.

Silver Mining at Cobalt.

The Cobalt silver mines have for the past few years been producing about 30,000,000 oz. of silver annually. It is not expected that the yield of high grade ore will be as great in the future; but there is every reason to expect a larger production than in the past of lower grade ore and a considerable production as well of high grade ore. The cost per oz. has increased, but there is now more ore being mined than ever before. To date the producing companies have made a profit from operations of about $60,000,000.

A large number of concentrating mills and several cyanide plants are in constant operation at Cobalt. Notable recent additions are the low grade ore plant of the Nipissing Mining Co., and an 80 stamp mill built last fall by the Northern Customs Co.

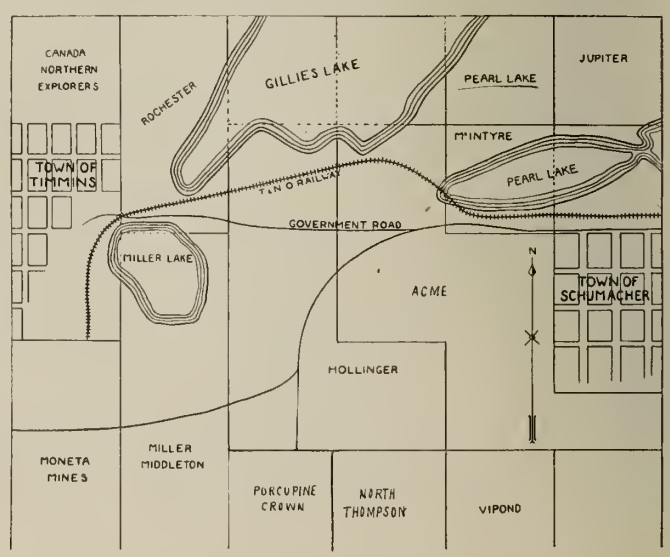
The treatment of the silver ores has resulted in the development at Cobalt of a very important metallurgical centre. Many skilled metallurgists have taken part in the development of the industry. Their remarkable success has resulted in making it possible to greatly decrease the cost of treatment.

At Cobalt the most important recent discovery is that made by the Peterson Lake Co. A promising shoot of ore was opened up a few months ago, and according to reports is holding well as development proceeds. The Seneca-Superior mine had an exceptionally profitable year and will be for some time a large producer of high grade ore. A good find was made last fall at the Kerr Lake property by draining the lake. During the coming summer the removal of the mud now lying on the bottom of the lake will be undertaken by the Crown Reserve and Kerr Lake Mining Companies.

Gold Mining at Porcupine.

Gold mining in Ontario has become of great importance since the opening up of large deposits at Porcupine. Five mines, Dome, Hollinger, Acme, McIntyre and Porcupine Crown, are now making regular outputs. The Acme is as yet not a large producer; but will be when equipped for mining. Its present production is from the treatment of ore mined during development work. The Hollinger is producing more ore than last year, and the mill to treat Hollinger and Acme ore is being considerably enlarged. The Porcupine Crown has blocked out ore valued at $2,000,000 in its upper levels. The development work has shown that there are important faults on the Porcupine Crown property, and it has proven diffieult to pick up the vein at the lower levels. Steady production can be maintained from the ore already blocked out, while

Hollinger Mine and Mill. Town of Timmins in the Distance



Hollinger and Neighboring Properties

Porcupine Crown Mine, Timmins, Ont.

Schumacher Mine

Shaft House and Stock Pile, Acme Mine

the work of exploration is carried on. The McIntyre has had a varied career, but is also an important producer.

At the Hollinger and the western part of the Acme the veins are comparatively easy to follow, now that a few of the peculiarities of the structure have been determined. Further south on the Porcupine Crown faults are giving considerable trouble. Further east on the McIntyre and Schumacher the ore bodies are very irregular in shape as well as having the usual variations in values. The development work is showing irregularities which might have been expected from the nature of the surface exposures.

Taken together the Hollinger, Acme, McIntyre and Porcupine Crown will certainly produce a large quantity of gold. The Hollinger and Acme properties are located on what appears to be by far the best part of the mineralized zone. The other two properties have valuable but smaller and less continuous ore bodies.

In addition to these four mines there are neighboring properties which may also become producers.

The Dome mine is situated in another part of the Porcupine district, and the deposit being worked is quite different to that at the Hollinger and adjoining properties. At the Hollinger the ore occurs in well defined veins forming a vein system. At the Dome the ore is in very irregular large masses. It averages considerably lower in grade than the Hollinger. Owing to the size of the ore body, however, it can be cheaply mined.

No. 2 Shaft, Power House and Mill, Dome Mine

The Dome Mines Co. has had in operation for some time a 40 stamp mill. This has been enlarged by the addition of 40 stamps and a sand leaching plant, which will soon be ready for operation. The ore is being mined largely from open pits. Underground, a very large ore body has been developed.

Gold Mining at Kirkland Lake.

At Kirkland Lake the Tough-Oakes mine, described in the April 15 issue of the Journal, is the most promising. Good results are also being obtained at the Teck-Hughes mine, where exploratory work is being steadily carried on by drifts and crosscuts at the 75 ft. level. It is expected that the Ontario Government will this year put the wagon road from Swastika to Kirkland Lake in good condition. This will be of great assistance in the development of the district.

A SUCCESSFUL METHOD OF AMALGAMATING IN CYANIDE SOLUTION.

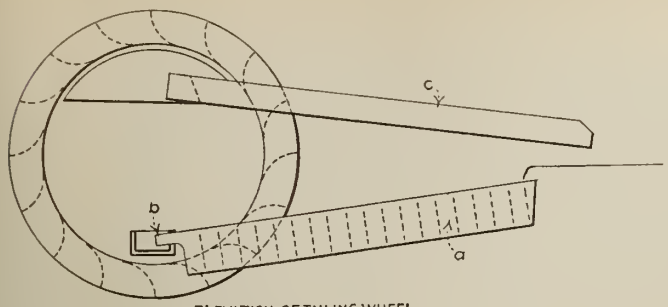
Mr. John Randall, in "Metallurgical and Chemical Engineering" describes a method of amalgamation in cyanide solution. He says that in case coarse gold is encountered in the cyanidation of ore, the question of amalgamation is not so important as formerly. When separate treatment of sand and slime was the general practice the question was quite important, but the problem was never satisfactorily solved. With the prevalence of all-sliming the case in quite different. The ore travels in a closed circuit through the fine grinder and classifier until reduced to slime, and any coarse gold which may happen to be in the pulp is thus "worn out" and gives no trouble in the extraction department. Therefore, in all-sliming mills it is considered good practice to simplify the process by cutting out amalgamation even when the ore contains coarse gold.

However, there are cases in which it is best to treat a part of the ore as sand, and then if it contains coarse gold the question of amalgamation comes up. To crush in water, amalgamate, dewater and then treat with solution occasions a loss of cyanide besides complicating the process; while amalgamating in cyanide solution has its drawbacks. In the latter case we have the gold cleaned and brightened by the cyanide solution and in the very best possible condition for amalgamation, but we are confronted by new difficulties. The solution attacks the plates, rapidly eating them away, while the amalgam is hardened by the dissolution of the mercury until it becomes unmanageable and the plates inefficient. The difficulties encountered have generally been sufficient to result in the abandonment of amalgamation in cyanide solution after many careful and persistent efforts.

It is the object of this article to bring into notice a phase of the subject which seems to have escaped general attention.

It is well known that if metallic sodium be mixed with mercury and immersed in a watery solution the action of the sodium in going into solution as NaOH at the surface of the mercury will produce practically the same result as that occurring at the cathode of an electrolytic cell. If there is gold or other metals in the solution they will be deposited upon the surface of the mercury and amalgamated. But in plate-amalgamation the mercury and sodium is spread out into such an exceedingly thin film that the sodium is rapidly oxidized and carried off, the good effect of it being noticeable for only a very short time after dressing the plates. This is the main reason why amalgamators generally regard sodium as of little or no value.

However, if riffles containing mercury be substituted for plates the last named difficulty is overcome, and it is possible to keep the quantity of sodium in the mercury fairly constant. Some time ago the writer was in charge of a mill, treating sand and slime separately, where gold nuggets the size of a pea were sometimes found, although the ore averaged a little below $10 per ton gold. The ore was a weathered dump and contained some copper as azurite, but no native copper. The



Use of Tailing Wheel to Return Part of Riffle Discharge

crushing was done in solution in a Chilean mill through 16 mesh screens. The mill was provided with plates, but they were taken out and riffles were substituted.

In cleaning up it was found that the greater part of the amalgam was so fine that it could be squeezed through chamois leather, and the bullion from the riffles was found to contain about two pounds of copper for each oz. of gold and silver. It is evident that the copper was deposited from the solution, and that in addition to recovering free gold that passed through the screens, the riffles had been of service in mitigating troubles arising from copper in the zinc boxes.

It was aimed to keep the amount of sodium just below the point where the mercury would amalgamate a freshly brightened iron nail. To accomplish this some mercury containing a large amount of sodium amalgam was kept on hand in a dry, glass stoppered bottle and a determined amount of this put into the riffles every four hours. No mercury was detected in the solution, and as none was floured, a weighing at the end of the run showed no loss except what might be expected in retorting.

In operating riffles it is found that those of the best design will choke when the feed is temporarily diminished below full capacity, and some trouble is experienced in getting them started again. This trouble may be obviated by placing a small tailing wheel in such a manner that it will return a variable amount of the outflow back to the head of the riffles, as shown in Fig. 1. By this means riffles of comparatively large capacity may be operated on a small amount of pulp. A section of the feed spout may be made to slide in telescope style, or a movable partition may be placed in the spout to cut out a variable amount of pulp.

I think it very doubtful if it would pay anybody to make riffles should they desire to use them with mercury, for this or any other mill purpose. The Pierce riffles, called the Pierce amalgamator, can be depended upon if given the proper amount of feed, and the sodium will protect the metal parts. They look somewhat expensive in first cost, but any riffles that will hold mercury and not pack with sand are open to the same objection. In operating riffles it is quite necessary to have a screen above them to intercept gravel that may occasionally come from a broken mill screen.

THE DRAINING OF KERR LAKE.

Permission having been granted on May 1st, 1913, by the Mining Commissioner of Ontario to the Crown-Reserve Mining Co., Limited, and Kerr Lake Mining Co., Limited, jointly, to pump out the water and mud from the bed of Kerr lake, construction work was immediately begun. The method of procedure follows:

A 100 ton barge was constructed, on which were installed four single stage pumps, each with a capacity of 1,800 gallons of water per minute, arranged in 2 units, each unit being directly connected to a 250 h. p. motor; the pumps having a 12 in. suction and a 10 in. discharge. At the beginning, as long as fresh water was being pumped and the head was not excessive, the pumps were operated in parallel, that is, each pump discharged independently into the main discharge line. Later against the greater head, and when the pumps were working on mud, the pumps were operated in series, that is, there was one suction for each unit, the water going from the first pump into the second pump, and then into the discharge line. The whole installation is very elastic, and adapted to any changes

A View of Kerr Lake Basin After Pumping Out the Water. Note the Silver Vein on the Rock Bottom.

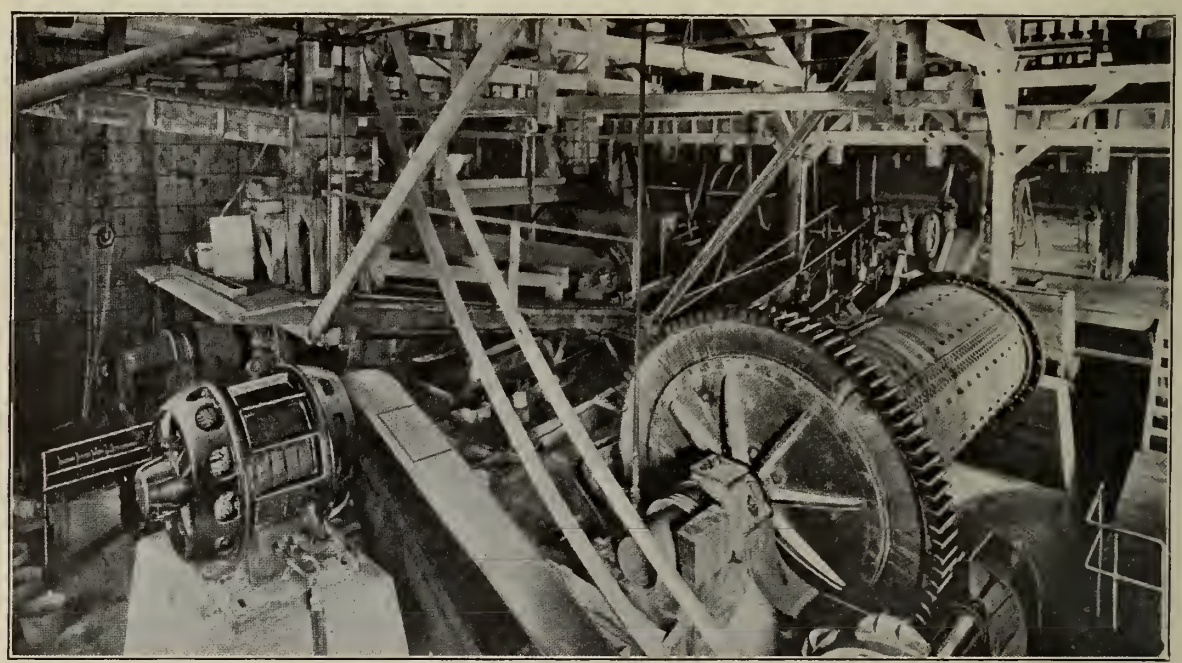
made necessary by new conditions. The barge was first anchored near the shore of the lake, and as the water was lowered, it was floated out to the middle of the lake, the connection between the shore and the barge being made by two universal ball and socket joints, and an expansion and contraction joint supported on floats.

A 20 in. pipe line was installed from the shore of Kerr Lake for a distance of 2,500 ft., where it discharged directly into Giroux lake, from whence it empties into the Montreal river.

Pumping was actively begun on August 28th, and four weeks thereafter most of the clear water had been pumped out, leaving the silt and mud still to be handled, and lowering the lake 28 ft. From that time until the freeze-up of November 28th, good progress was made in pumping the mud, although the rate of pumping was much less than that of handling the water. It was found that there was an average depth of 25 ft. of mud and silt over the whole lake after the clear water had been removed. In all, 325,000,000 gall. of water and mud were pumped out, the lake being lowered a total depth of 38 ft. The operation of pumping the mud will be renewed as early as possible in the spring, and during the next summer all of the mud should be removed. It may be necessary in connection with this work to put in some kind of a sluicing plant to wash all of the mud into the pump in the middle of the lake, but the cost of such a plant will be nominal.

The total cost of plant installation, including a fresh water plant on Giroux lake, capable of handling 1,000 gall. per minute, was:

For distribution of fresh water	$39,604.76
The total operating cost to date is	12,078.29
The total expenditure to date is	$51,683.05

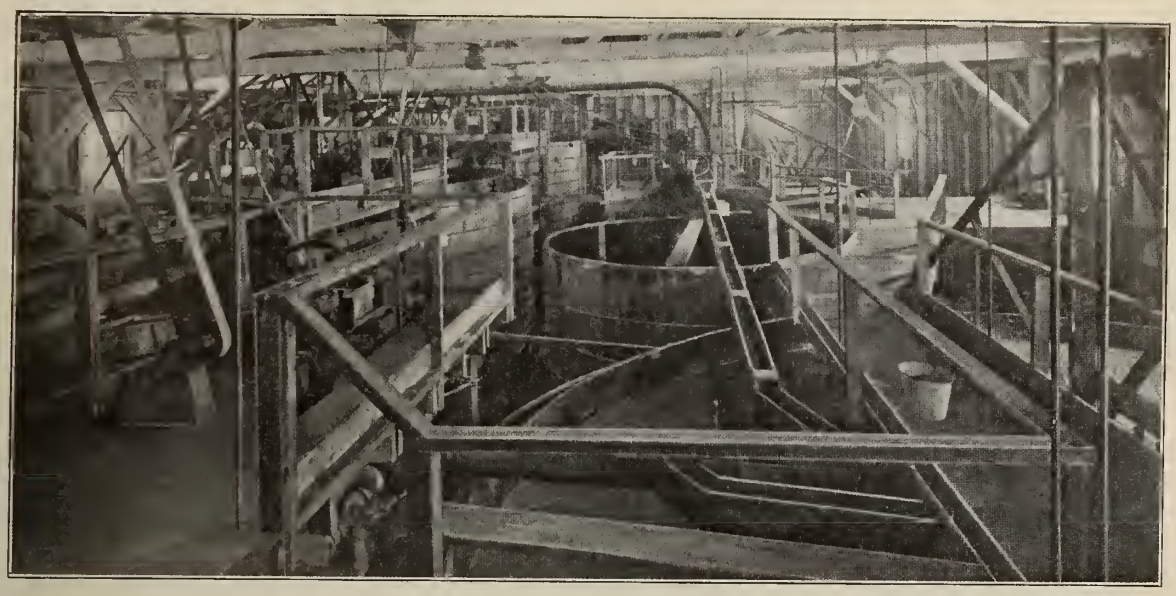


Porcupine Crown Mill

CROWN RESERVE.

Mr. S. W. Cohen, in the annual report for 1913 says in regard to the Carson vein: "Because of the irregularity of the silver values and of the high grade veins in the Cobalt district, and the great error in sampling, it is almost impossible to absolutely estimate ore blocked out unless small blocks can be sampled on four faces; especially at the 100 ft. level of the Crown-Reserve mine, with the lake overlying, which meant only one face exposed, such an estimate at best would have been only a guess. Rather than hazard such an estimate, the general manager has always stated the physical conditions and probabilities of the property so that the directors could for themselves deduce an estimate of the probable value of the property. The method of stating these probabilities was to take a certain block of ground from which the ore had been extracted, and the contents of course known, and to assume by analogy that the block immediately above this would be of the same approximate value, if the face exposed was similar to the ore extracted. This was based on the fact that practically all the development work in the whole Cobalt district, in the conglomerate formation, and especially on the Crown-Reserve property, had demonstrated that the ore bodies remained at least as rich, if not richer, as the surface was approached from below. In fact this was the only method possible at the 100 ft. level of the Crown-Reserve, as no raises could be put up because of the lake overhead, so that the ore could be sampled on only one face, and a result deduced from the samples of ore exposed on one face only would be subject to a much greater error. The results of the methods described have generally checked the estimates of probable ore with remarkable fidelity during the whole history of the mine, and now that it has been possible to put raises up to the bed of the lake, these estimates have been very closely checked by sampling.

"It, of course, needs no demonstration to assume that, while the method described will closely approximate the estimates on a large number of blocks, any individual block might vary greatly from the value as based on the block below. This is what happened on the Carson vein, Only one face could be seen, and while in the last annual report no statement was made as to the probable value of the remaining ore in the Carson vein, it was stated that 25 per cent. of the 100 ft. stope was left, and it was hoped that 25 per cent. of the value of the entire



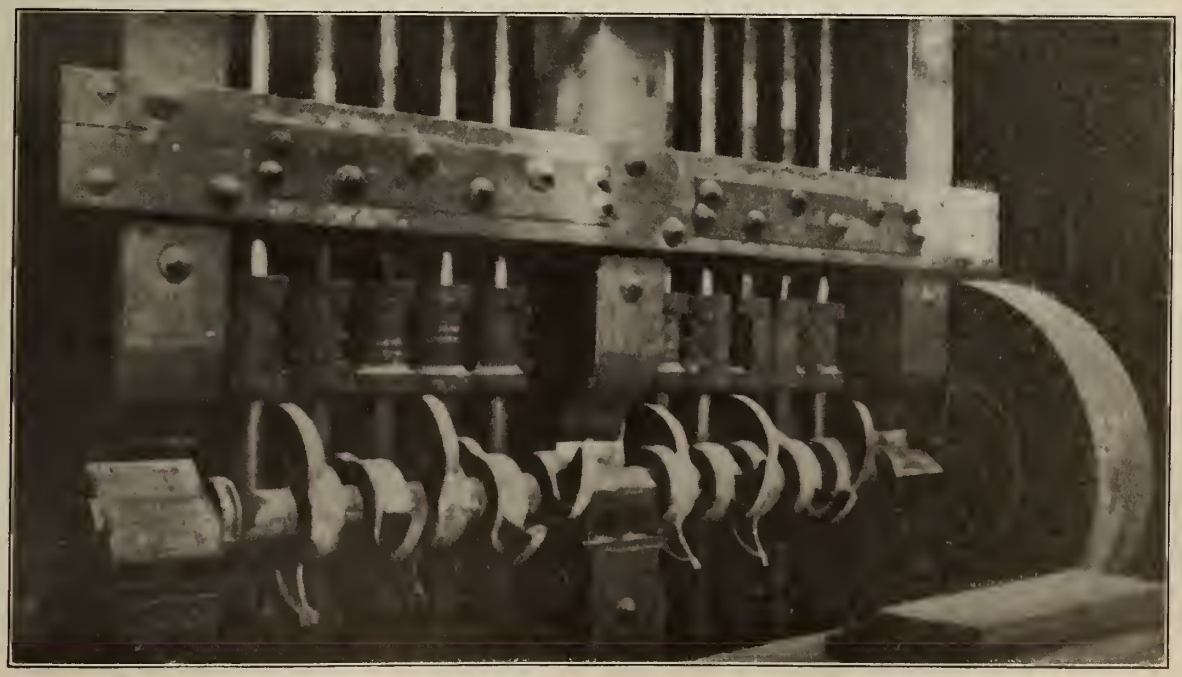
Porcupine Crown Cyanide Plant

stope, or practically 1½ million oz., would be extracted from this block of ground, especially as this vein had always been very regular in value. Subsequent work on this ore body, as already stated, has proved to be very disappointing, and, as a result, the earnings of the company for the past year were very materially decreased. When the lean ore was first encountered, it was hoped that the conditions were merely local, but continued development work during the past twelve months has produced only 200,000 oz. of silver, and has demonstrated that no material amount of high grade ore can be further expected from this vein.

PORCUPINE-CROWN MILL AND CYANIDE PLANT

A small five stamp mill was started up in February, 1913. This was operated on straight amalgamation and was primarily intended for a test mill, but as the results were so encouraging, it was run regularly on its full capacity, while experiments were carried out as to the treatment of a larger tonnage.

Up to the time the cyanide plant was installed, this mill showed an average extraction of 85 per cent., the tails being impounded and available for future treatment by cyaniding. The result of experiments on the testing mill showed that the continuous decantation process of cyaniding the ore, as introducted by the Dorr Cyanide Machinery Co., was especially suited to the ore, and that this method would prove the least expensive in installing and operating. As a result, a further 15 stamps, duplex classifier and tube mill, as well as the cyanide tanks, pumps, etc., were installed and cyanide work begun about the middle of November, 1913. Since this time, the mill has been making an extraction of 96 per cent. at an average cost of $1.50 per ton, treating 100 tons per day. Experiments are being carried out which



10 of the 40 New Stamps, Dome Mill

show that a further recovery of 1 per cent. may be made by small changes. The mill has not been running long enough to give complete detailed figures, but the manager is satisfied that as a result of this method of treatment, the extraction will be as high and the costs less than by any other method. The maximum capacity of the mill is 180 tons per day.

THE DOME MILL.

Forty additional stamps have been installed at the Dome mill during the winter, and the sand leaching plant will soon be ready. In the present mill all the ore is slimed in tube mills. When the new plant is in operation the circuit will no longer be a closed one. The sands will be separated and leached in large vats. Cones will be used for settling. The accompanying photographs show one of the new batteries and views of the settling cones and leaching vats.

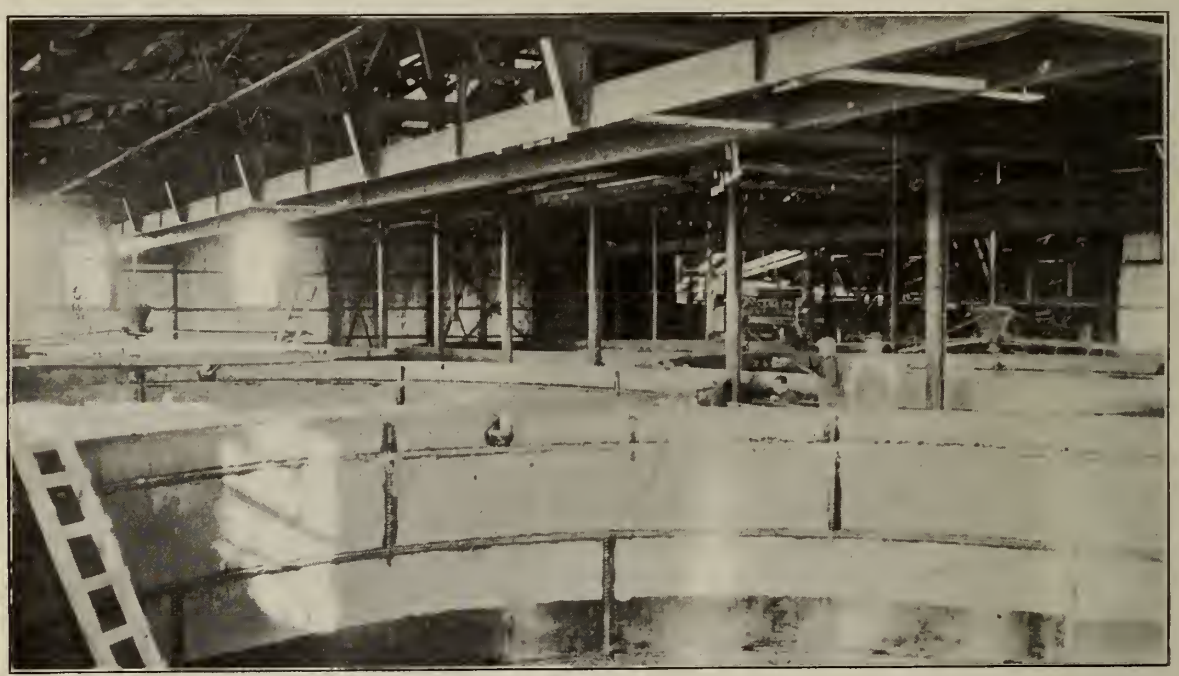
Classifying Cones, Dome Mill

The heavy coarse particles separated in the classifying cones from the lighter sand will be returned to the tube mills for regrinding. The circuit is therefore a closed one so far as concentrate is concerned.

The new plant is being installed by the Merrill Metallurgical Co., Mr. F. C. Languth is in charge of the work.

The 40 stamp mill now in operation, which was also installed by the Merrill Co., has been making a very large output under the supervision of Mr. W. F. Battersby, of the Dome Mines, Ltd.

With these forty stamps and the leaching plant in operation the production of the Dome will be very much larger than at present.



View of Leaching Vats, Dome Cyanide Plant

THE PREPARATION OF METALLIC COBALT BY REDUCTION OF THE OXIDE.

The Mines Branch has issued a bulletin describing in detail methods of preparing metallic cobalt from the oxide.

There are four methods of reducing commercial cobalt oxide, in order to obtain metallic cobalt in reasonably pure form:

1. By reduction with carbon.
2. By reduction with hydrogen gas.
3. By reduction with carbon monoxide gas.
4. By reduction with aluminum.

Each of these methods has been studied at considerable length, and this paper is a report of the results. It should serve as a guide to those who will subsequently be interested in the preparation of metallic cobalt in large quantities. Copies of the bulletin may be obtained on application to the Mines Branch.

The researches were conducted at the School of Mining, Queens University, Kingston, Ontario, for the Mines Branch of the Department of Mines, by H. T. Kalmus, assisted by C. W. Day, C. Harper, W. L. Savell and R. Wilcox.

RADIUM AND ITS ORES

By R. A. A. Johnston.

The discovery of the element radium by Mme. Curie at the end of the last century was the culmination of a long series of experiments and researches prosecuted by many investigators. A few years previous to this discovery Becquerel had observed that a photographic plate wrapped in black paper was markedly affected when brought into proximity with a compound of uranium. Later on Mme. Curie found that the residues left after the extraction of uranium from its ores were much more active in this respect than was uranium itself. Stimulated by this discovery Mme. Curie carried her researches still further and in the course of a long and laborious series of separations of the constituents of these residues found that there were two substances which were capable of affecting a photographic plate in the way mentioned. In the course of these separations one of these substances was found to associate itself with the bismuth; to this substance Mme. Curie gave the name of polonium after her native country Poland; the other associated itself with barium and on account of its strongly radio-active properties was called radium.

Properties of Radium.

It must be remembered here that radium itself has not been liberated as a separate entity and that it is only in its compounds such as the chloride, bromide, nitrate, etc., that it has been studied. These compounds are luminous of themselves and have the power of imparting luminosity to many other substances when brought into proximity with them; they charge electrically vessels containing them; they of themselves give off heat continuously; they have marked effect on photographic plates and in many other ways display remarkable properties.

These active properties of radium are due to a kind of decay by which it, in all probability, gives rise to other elements. This decay is so uniform and of such potentiality that the amount of radium in a substance may be actually estimated from the emanations issuing from it. This is done by means of an instrument called an electrometer.

It is natural to suppose that a substance possessing such unusual properties should at once attract attention with a view to ascertaining its possible practical applications, and nowhere has greater activity been shown than in its possible application as a curative agent for some of the ills to which humanity has fallen heir; and in this connection extensive investigations have been carried on with a view to ascertaining the effect of the emanations from radium upon that greatest of human evils, malignant cancer. The results have undoubtedly been most startling, but the public would be well advised to reserve final judgment upon the merits of radium as a curative agent until the permanency of these results has been proved. In the opinion of the best authorities this may not be ascertained for some years to come. For all this the results of these experiments have been of such a character that various Governments have thought it expedient to take such steps as will tend to conserve any supplies of radium ores coming within their jurisdiction and in some instances have gone so far as to prohibit their export.

As has already been stated the ores of uranium were the first to attract attention as possessing any unusual radio-active properties and it is from such ores that all of the radium of commerce has been obtained. Radio-activity of greater or less potentiality has been observed in a great variety of materials both liquid and solid, but whether this radio-activity is in all cases due to the presence of radium is not absolutely clear. The waters of some springs are known to show considerable activity and on this account wonderful curative properties have rightly or wrongly been ascribed to them. The petroleums issuing from many oil wells show more or less radio-activity; some of the petroleum from the Interlake Peninsula of the Province of Ontario have been shown to exhibit marked radio-activity; this has been particularly marked in some of the heavy oils found in the deeper wells. Amongst the solid constituents of the earth's crust, crystalline rocks such as the granites have been noted as sources of radio-active emanations and in this case the emanations are probably due to the presence of uranium bearing minerals; generally speaking, however, the amount of uranium in these rocks is so minute that its presence may only be detected by the most critically conducted chemical analysis and the instances in which the presence of uranium is manifested in the form of a distinct mineral are comparatively rare and for the most part are found in the coarse granites known as pegmatites; occurrences of this kind have not yet been found to be profitable sources of uranium or radium. Until quite recently certain metalliferous veins of secondary origin furnished the only source of commercial radium; the silver and copper-bearing veins of Schneeberg in Saxony, Joachismthal in Bohemia, and Rezbanya in Hungary, which sometimes hold more or less of the mineral pitchblende, are examples of this kind. At a few places in the world uranium-bearing minerals have been found in connection with certain sandstones and conglomerates, rocks of sedimentary origin. These rocks have been formed from the detritus occasioned by the breaking down, by aqueous or other agencies, of vast quantities of crystalline rocks; the constituents of these rocks during transportation by stream agencies have undergone a selective process according to the laws of gravity by which the heavier minerals have been segregated amongst themselves; in this way the uranium bearing constituents of the crystalline rocks have become concentrated; these constituents have subsequently become oxidized and have given rise to a class of minerals different in some respects to those indicated previously; examples of this kind are the commercially important deposits of carnotite found within recent years in Colorado and Idaho in the United States.

A brief description of the principal uranium bearing minerals may not be out of place here.

The mineral uraninite, which includes a number of varieties such as cleveite, broggerite, and pitchblende based on slight differences in composition, is found as a primary constituent of some granite rocks and also as a secondary mineral along with ores of silver, copper, lead, etc. It is a heavy mineral with a specific gravity of about 9 to 9.7 (water-1); the lustre varies from sub-metallic through greasy to dull and the color from grey through green and brown to velvet black. It contains from 75 to 88 per cent. of oxides of uranium.

Gummite occurs in the form of rounded or flattened

pieces frequently with uraninite in dikes of pegmatite. It has a greasy lustre, and in color varies from reddish yellow to reddish brown. It occurs as an alteration of uraninite and includes a number of sub-varieties.

Then there are a number of other minerals more or less closely allied with these in point of composition and modes of occurrences, but which need not be touched upon here as so far they have not attained to any commercial importance.

Then we come to that class of uranium-radium minerals which are found in sedimentary deposits, and these for the time being at least bid fair to attain to the greatest importance commercially. Their mode of formation has already been touched upon. The principal mineral of this class is carnotite a compound containing vanadium, uranium, and potassium often with more or less adventitious materials. Carnotite is of a bright yellow color and appears both as a very fine powder and as a crystalline efflorescence.

Occurrence in Canada.

In Canada the number of localities in which uranium bearing minerals are known to occur is comparatively small and so far only small quantities have been obtained from them. Many years ago the mineral uraninite was reported from Mamainse on the eastern shore of Lake Superior and was described under the name of coracite. It was said to occur in a vein 2 in. in width in syenite in contact with a trap rock. Efforts have been made at various times within recent years to rediscover this vein but so far these have been fruitless. The mineral uraconite, a sulphate of uranium, has been observed lining cavities in the magnetic iron-ore of Snowdon in Peterborough county and a similar occurrence has been noted in Madoc in Hastings county; a pegmatite in the township of Lyndoch in Renfrew county has also yielded specimens of minerals possessing radio-active properties. These localities are in the Province of Ontario. In the Province of Quebec uraninite and its alteration product gummite have been observed at the Villeneuve mica mine in the township of Villeneuve and also in a pegmatite vein in Wakefield, both in Ottawa county; the mineral monazite, a phosphate of rare earths, which also possesses radio-active properties, has been found at the Villeneuve locality. In the township of Maisonneuve in the county of Berthier the mineral samarskite has been found in a mica-bearing pegmatite; this mineral was found by Hoffman to contain 10.75 per cent of oxide of uranium. Uraninite is also known to occur at a mica mine about 18 miles north of Murray Bay in the county of Saguenay. At this locality too a curious carbonaceous mineral resembling anthracite in its general appearance has been noted by Obalski. This mineral yielded 2.56 per cent. of uranium.

While as yet no commercial deposits of uranium ores are known to exist in Canada there is no reason to suppose that such may not be found, and prospectors would do well to maintain a close watch for anything that may contain this element. Special regard should be had for any minerals with a pitchy lustre and also for earthy or finely crystalline minerals having a bright yellow color. It might be well to provide oneself with one or two simple instruments for detecting radio-activity. An electroscope is particularly useful, but cannot always be carried about conveniently. For all practical purposes a scintilloscope is the most convenient instrument; one may be had for about a dollar, but it should be carefully tested with a mineral of known radio-active properties before taking it to the field and great care should be taken to maintain its efficiency; its usefulness may soon vanish through careless handling. —Geological Survey, Department of Mines, Canada.

THE MOND PROCESS OF SEPARATING NICKEL AND COPPER*

By A. P. Coleman.

The bessemer matte produced by the Mond Company at Victoria Mines is shipped to Clydach, a suburb of Swansea, Wales, for final treatment by one of the most ingenious processes imaginable. It was discovered in 1889 by Dr. Carl Langer, working in conjunction with Dr. Ludwig Mond, that carbon monoxide, passed at a temperature not exceeding 80° centigrade over finely divided nickel, combined with the metal to produce a gas, nickel carbonyl, which could be decomposed again at a temperature of 180° C., thus depositing the nickel. The process was patented and an experimental plant was erected in 1892 at Smethwick, near Birmingham, to test it. As described by Roberts-Austen in 1899, the process was developed during some years of patient work, in which the plant had several times to be reconstructed to make it a practical success.

Essentially five operations are required in order to produce the nickel, (1) dead roasting to drive out as much of the sulphur as possible; (2) the extraction of about two-thirds of the copper of sulphuric acid the resulting sulphate of copper being sold in that form; (3) the reduction of the nickel and remaining copper to the metallic state by water gas or producer gas rich in hydrogen in an apparatus called a "reducer," the temperature of which is under perfect control, so that 400° C. is never exceeded; (4) from this apparatus the substance, now reduced to the metallic state, is taken through air-tight conveyers and elevators into another apparatus called a "volatilizer" in which it is subjected to the action of carbon monoxide gas at a temperature not exceeding 80° C.; (5) the nickel carbonyl thus produced passes into the "decomposer," a tower or horizontal retort heated to 180° C. so as to release the nickel in the metallic state.

The process is not complete in one passage through the five stages, however, and the materials are made to circulate for a period varying from 7 to 15 days between stages (3) and (4) until about 60 per cent. of the nickel has been removed as carbonyl. The residue from this operation, amounting to about a third of the original calcined matte and not differing much from it in composition, is returned to the first operation and follows the same course as before.

In operation (5) the carbon monoxide is released and is returned to the volatilizer to take up a fresh charge of nickel. When the operations are in progress the carbon monoxide gas and the partially reduced oxides of nickel and copper are continually revolving in two separate circuits which join and cross each other in the volatilizer (4). The nickel is deposited on granules of ordinary commercial nickel which are automatically removed after reaching a certain size; and the product contains between 99.4 per cent. and 99.8 per cent. of nickel.

Roberts-Austen describes the process as he observed it at Smethwick as follows:—

"The material under treatment during the author's visit was of Canadian origin, and had been received as calcined bessemer matte containing 35.4 per cent. of nickel, 41.8 per cent. of copper, and about 2 per cent. of iron. This material was first passed through a ball

*Extract from the monograph on the Nickel Industry, published by the Department of Mines.

mill and dresser with a sixty-mesh riddle, and was then treated in quantities of 3 cwt. in a small lead lined mixer with 200 lb. of ordinary sulphuric acid which had previously been diluted with about 20 cubic ft. of mother liquor from previous operations. The temperature of the mixture soon rises by the action between the copper oxide and the sulphuric acid, and is kept, by means of a steam jet, at a temperature of about 85° C., for half an hour. From this mixer, the charge is run out into a centrifugal hydro-extractor, provided with a filtering cloth, in which the solution of copper sulphate is separated from the solid residue containing the nickel. After the filtration of the charge is finished, the speed of the hydro-extractor is increased, and the residue is thus rendered sufficiently free from the liquor.

"The solution containing the extracted copper runs from the hydro-extractor into a well, from which it is pumped into crystallizing vats. After a period of about 8 days to 10 days, the crystals of copper sulphate are taken out of the vats and the mother liquor is mixed with fresh acid and is again used for the extraction of copper. As already mentioned, a small amount of nickel and a little iron are also dissolved in the sulphuric acid during the copper extraction, so that the mother liquor reducing tower and discharges it through another rotary valve into this reducing tower.

"The reducer and the volatilizer in which the treatment with carbon-monoxide takes place, are fully described in Dr. Mond's patent (No. 23,665 of December 10, 1895). The reducer consists of a vertical tower about 25 ft. high, containing a series of shelves, which are hollow so as to admit of their being raised to a temperature of 250° C. by producer gas. The roasted matte falling on these shelves from above is stirred and made to descend from one shelf to that below it by rabbles actuated by a central vertical shaft. Water-gas passes up the tower to effect the reduction of the material. There are about fourteen of these shelves or trays in the tower. The five lower shelves are not heated by producer gas, but are cooled by a stream of water in order to reduce the temperature of the roasted and reduced matte to the temperature at which the volatilizer is worked.

"The volatilizing tower resembles the reducer, but the shelves are not hollow, as there is no necessity to heat them. The reduced nickel requires a temperature of only 50° C. to enable it to combine with carbon monoxide and form a volatile compound, and the matte and gas are sufficiently hot to maintain this temperature. In

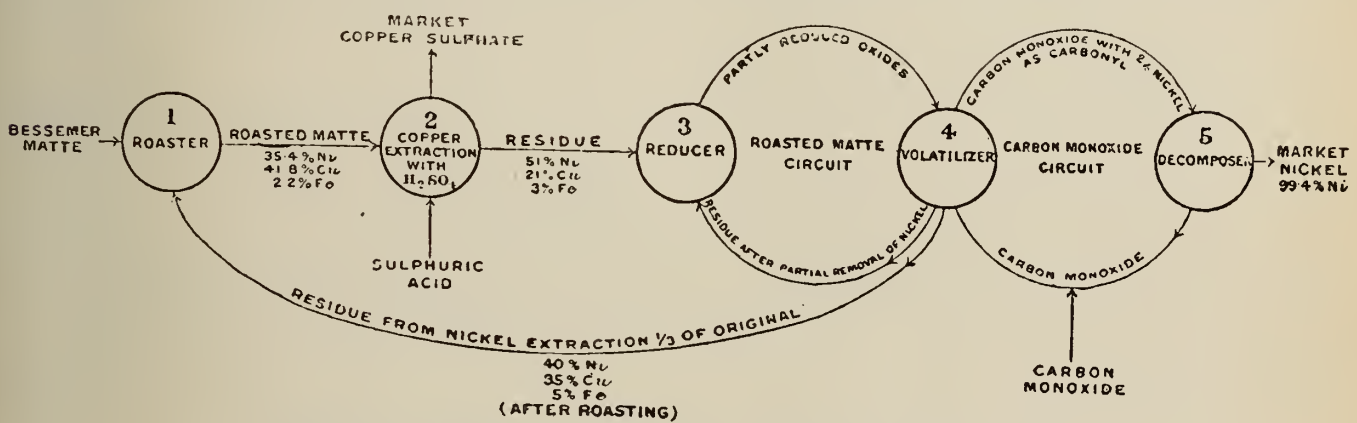


Diagram Illustrating the Five Operations Involved in the Mond Process

from which the copper sulphate has crystallized becomes gradually contaminated with these two metals. It is therefore necessary to replace some of the mother liquor from time to time by fresh water, and to recover the nickel from the solution. The simplest method is to evaporate the solution to dryness and to roast the nickel and copper sulphates so obtained. The oxidized material is again introduced into the main process. The copper sulphate crystals from the crystallizing vats are charged into a second hydro-extractor, where they are washed with a little clean water to remove all acidity; they are then dried and are ready for packing. The copper sulphate thus obtained is sufficiently pure for market, as it contains only 0.0 ; per cent. of nickel and 0.048 per cent. of iron.

"The residue from the copper extraction is taken from the hydro-extractor and stored in a bin until a sufficient quantity has been collected to make up a charge of 5 tons to 6 tons for the nickel extracting plant. It now contains 52.5 per cent. of nickel, 20.6 per cent. of copper, and 2.6 per cent. of iron. The material is charged by hand at the rate of half a ton per hour into a feeding hopper, which communicates, through a rotary valve, with the conveyer, consisting of a tube enclosing a revolving spiral, which transports the material to an elevator. This lifts the material to the top of the

the plant at Smethwick the volatilizer was made the same size as the reducer, but in the new plant it is somewhat smaller.

"The decomposer has been devised with much care, and has, in its present form, only recently been patented. The nickel is deposited in it, from its gaseous compound with carbon-monoxide, on granules of ordinary commercial metal. The arrangements by which this is effected are very ingenious, and may be described almost in the words of Dr. Mond's latest patent. The object is to obtain metallic nickel from nickel carbonyl in the form of pellets, which are specially suitable for the production of nickel alloys. For this purpose gases containing nickel carbonyl are passed through granulated nickel, which is kept at the temperature required for the decomposition of the carbonyl, about 200° C. The nickel which thus separates from the carbonyl becomes deposited on the granulated nickel, which consequently increases in size. In order to prevent cohesion of the granulated nickel, it is kept in motion. When a number of the pellets have attained a convenient size, they are separated by sifting without interrupting the depositing operation, the smaller granules being returned to receive a further deposit from the nickel carbonyl.

"A magnified section of a granule of nickel, shows a core of nickel with a crystalline and convoluted struc-

ture surrounded by concentric layers. The central core is ordinary commercial nickel, and the layers are nickel deposited from its carbonyl. In some cases granules of deposited nickel are found without any central core. These have grown from minute fragments of deposited nickel which have become detached during the course of deposition.

"The solid material from which the nickel is being extracted is kept circulating through the reducer and volatilizer for a period varying between 7 days and 15 days, during which time the oxides are gradually reduced to the metallic state and the nickel volatilized. When the material originally charged in has had the bulk of its nickel extracted it is run out through a rotary calciner roaster, which converts the metals into oxides, so that they may be treated for the second time with sulphuric acid and carbon-monoxide. The ratio between the nickel and copper in the residues from the nickel extraction is practically the same as in the calcined bessemer matte, with which the operations were started, but the amount of iron has increased by the removal of the copper and nickel, as the following figures show: Original matte contains, nickel 35.27 per cent., copper 41.87 per cent., iron 2.13 per cent. After the first treatment of copper and nickel extraction, the quantities are, nickel 35.48 per cent., copper 38.63 per cent., iron 4.58 per cent.; and after the second copper and nickel extraction, nickel 35.83 per cent., copper 35.56 per cent., and iron 7.82 per cent. The amount of nickel extracted in these two cases was, after the first treatment, 61 per cent., and after the second treatment 80 per cent. of the nickel present in the original matte. It must be remembered, however, that in the second treatment only one-third of the original amount remains to be treated, while the final residue is only one-tenth. To avoid the formation of iron carbonyl, the temperature in the reducer has to be kept very low, and if this is done, the nickel extracted from a matte originally containing as much as between 6 per cent. and 10 per cent. of iron will not contain more than 0.5 per cent. of iron. If the amount of iron in the residues rises above this percentage, the extraction of the nickel is very much delayed, on account of the low temperature which must be maintained in the reducer. It is necessary, in such a case, to re-smelt the residues before proceeding with the extraction of the nickel and copper."

The works at Clydach are equipped in the way described by Roberts-Austen but with many more units, so as to produce 1,700 tons of nickel, 7,000 tons of copper sulphate, and 800 tons of nickel sulphate including a little nickel ammonium sulphate. Dr. Langer states that the nickel now produced is 99.98 per cent. pure and is sold in the shot form to the Armstrong Co. for armor plate and to smaller firms of steel workers and producers of German silver and nickel plate. Some is sold also to Arthur Krupp, and to a pure nickel goods company at Berndorf near Vienna.

The works show none of the roughness and disorder of the usual metallurgical plant, but are as clean and scientifically managed as a laboratory, everything being accurately adjusted, and the temperatures of the different parts being frequently taken and recorded.

The gases employed in the process are very poisonous but so much care is taken as to joints and fittings that for eight years there have been no cases of poisoning.

The plant is run continuously except for a stop of three weeks in the year to clean flues and repair machinery; and the demand for nickel has increased so much that plans are made to double the present works.

Clydach, being in the midst of the Welsh anthracite and steam coal fields, supplies at a minimum of expense the varieties of coal needed for the production of carbon-monoxide and for other purposes in the running of the plant, as explained by Dr. Langer, and also gives a convenient distributing point for the sulphate of copper and other products resulting from the process.

ACCIDENTS FROM EXPLOSIVES.

The chief inspector of mines for British Columbia quite recently sent to all district inspectors of mines in that Province a circular letter, as reprinted below. Copies were also sent to managers of the larger mines.

In further reference to accidents from explosives in the metalliferous mines of the Province:

Drilling or picking into powder, either in miss-fire or cut-off holes or in the muck, accounts for a large percentage of the serious and fatal accidents in the metalliferous mines, and anything that can be done to reduce the number of these accidents will be of much value to the industry.

Within the past year the manufacturers of explosives have been placing on the market a non-freezing explosive, and several of the large producing companies have adopted the use of this powder to the exclusion of all others.

Some time ago a report reached me that at the Britannia mine, on Howe sound, where this kind of powder was in use, miss-fire holes had been drilled into without exploding the powder.

Through District Inspector of Mines John Newton, inquiries were instituted relative to the same, and on the authority of Mr. Wylie, the superintendent of the Britannia mine, I learn that the above reports are true.

The circumstances as stated by Mr. Wylie are as follows:

(1) That a workman named Pearson was drilling boulders in a stope when he drilled through a miss-fire hole containing six (6) sticks of non-freezing powder, with no explosion of the powder.

(2) That John McKinnon, a driller, was drilling a rise-hole in a stope when he drilled into a missed hole. This workman did not know he had drilled into powder until it came out of the mouth of the hole in the drillings.

(3) Mr. Wylie, the superintendent, reports seeing some of the explosive entering the rolls in the mill, and warning all the workmen near to run, expecting the powder to explode; no explosion resulted in this case. Several small explosions had occurred in the rolls while using the ordinary explosives.

It would seem from these facts that there is a greater margin of safety in the non-freezing explosive than in that formerly used, and this alone would justify the mine owner in investigating the same.

The benefits derived would seem to be:

1. Fewer accidents from actual contact with the powder by drill or pick.

2. No thawing required, reducing risks from thawing and extra handling in thawer.

3. Powder always in condition, reducing the chances of powder being unexploded.

The price of the powder is the same as of the ordinary dynamites, and the results in production of ore per lb. used are not affected.

The use of non-freezing powder by the prospector and small operating companies—where the means of thawing is often very crude—would seem highly desirable.

ORE DEPOSITS OF THE SIMILKAMEEN DISTRICT, B.C.*

By Charles Camsell.

Nickel Plate Mine.—The Nickel Plate mine is situated on the eastern slope of Nickel Plate mountain at an elevation of about 5,700 feet above sea level. The ore deposits in it are of contact metamorphic origin and occur at the contact of dykes and sheets of gabbro in limestones which have been altered by the gabbro. They are irregular in outline and have usually a well-defined boundary only on the side of the gabbro.

The gangue of the ore bodies contains minerals formed by the alteration of limestone, including garnet, epidote, diopside, amphibole, quartz, calcite and axinite.

The principal ore mineral is arsenopyrite, with which occur chalcopyrite, pyrrhotite, zinc blende, pyrite, native gold, and sometimes tetradymite. These minerals are distributed through the gangue in crystallized individuals, or fill minute fractures in it. The valuable content of the ore is gold alone, which in that now being mined, averages about $11 to the ton.

These deposits afford an excellent illustration of contact metamorphism induced by the intrusion of igneous bodies into calcareous rocks, and show the resulting alteration of the original carbonates to silicates. They illustrate also the formation of ore bodies by the transfer of ore material from the igneous rock to the sedimentary, under such conditions of temperature and pressure, that the constitutents introduced, and those originally present and recrystallized, are intergrown together as a result of contemporaneous crystallization.

In the association of gold with arsenopyrite in deposits of this origin the Nickel Plate ore deposits are unique and have no known counterpart on the continent. In the classification of ore deposits, they are therefore placed in a division by themselves, and are called the "Arsenopyrite type" of contact metamorphic deposits.

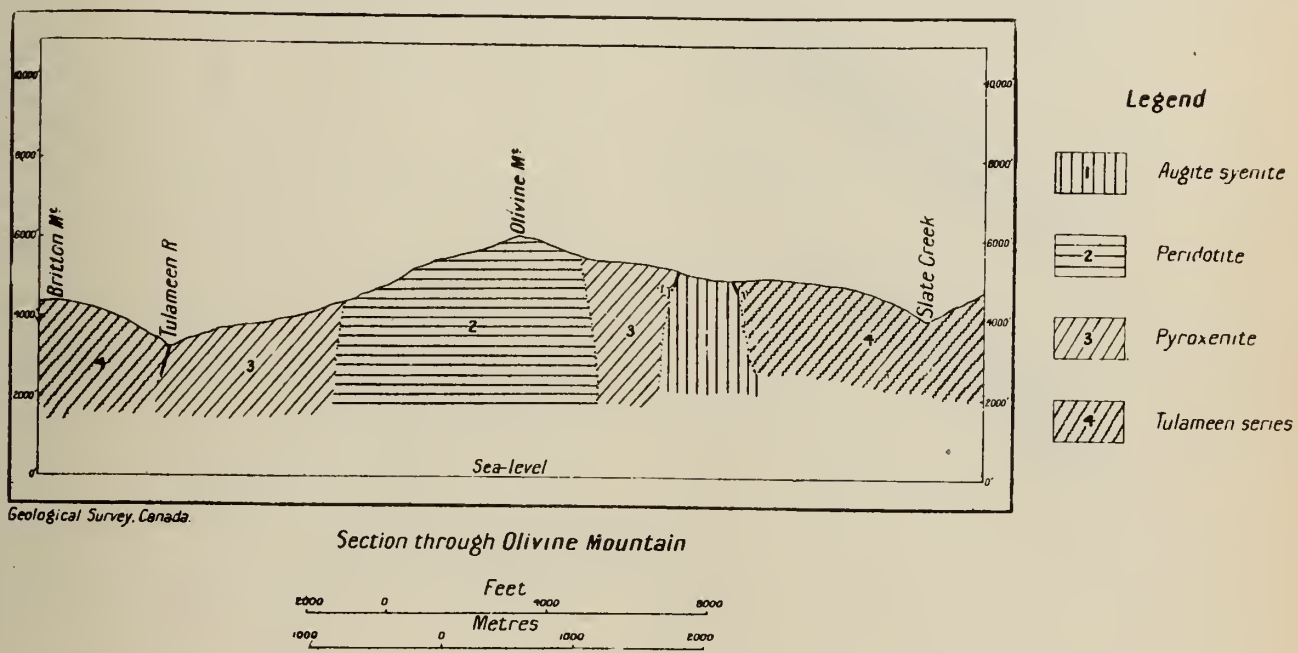
The Hedley Gold Mining Company employs about 60 men in the Nickel Plate and Sunnyside mines on the top of Nickel Plate mountain, and operates a system of electric and gravity tramways which carry the ore from the mines to the mill. The electric tramway is about a mile in length, while the gravity tramway is 10,000 feet in length, and drops nearly 4,000 feet.

The mill is situated at the town of Hedley and treats an average of 160 tons of ore per day. It is equipped with 40 stamps, two tube mills, and cyanide tanks, and is operated either by water power or steam. The ore being treated has an average value of about $11 to the ton from which an extraction of 95 per cent. of gold is made. Up to 1913 a total of about $3,250,000 in gold has been recovered from Nickel Plate ores mined.

Princeton Coal Seams.—On the east side of Similkameen River, at the end of the traffic bridge, the outcrop of a coal seam is seen. The total thickness of the seam is 25 feet, but it contains several small bands of clay. The associated rocks are shale and sandstone. The coal dips S. 30 degrees W. at an angle of 12 degrees and is traversed by a few normal faults which strike S. 45 degrees W. The throw is usually only a few feet, the downthrow being on the north-west side. The mineable parts of the seam are a bench 7 feet to 10 feet thick in the upper half, and another bench 7 feet thick in the lower half. Only the upper bench is at present being worked.

The coal is sub-bituminous, excellent for domestic use and for the manufacture of gas. A sample of the seam being mined gives the following proximate analysis:

	Per cent.
Moisture	16.17
Volatile combustible matter	37.58
Ash	4.58
Fixed carbon	41.67
	100.00



*Extracts from Guide Book, No. 9, prepared by the Geological Survey of Canada, for Twelfth Session International Geological Congress, August, 1913.

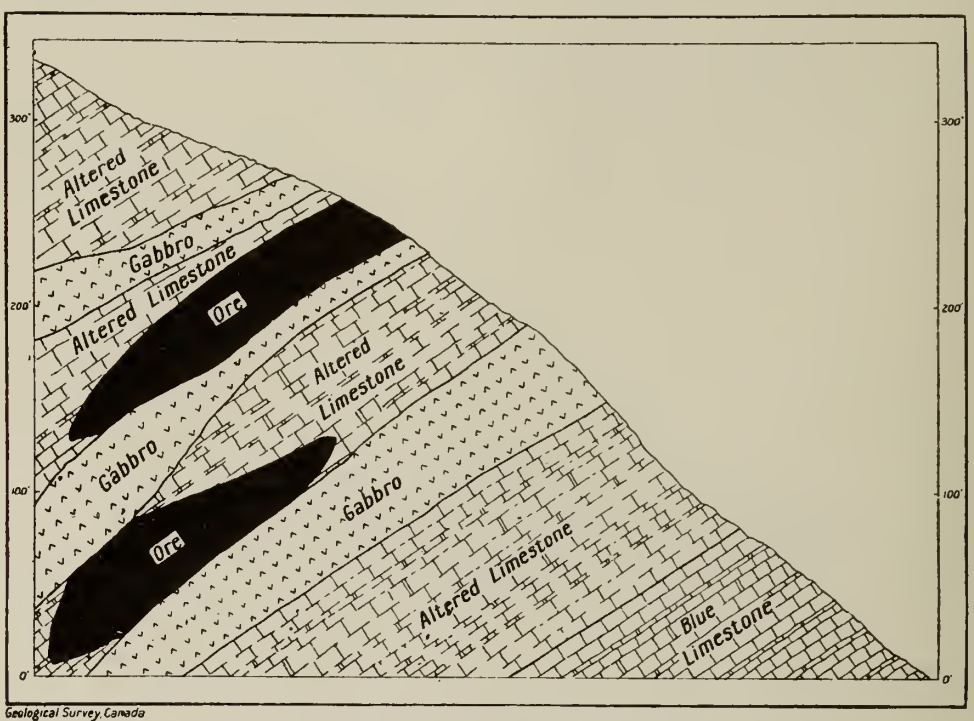
The coal-bearing rocks cover an area of about 40 square miles and virtually the whole of this area is taken up in coal mines. Prospecting and development work are being carried on at a number of points in the basin, but shipment of coal is being made only from the collieries of the Princeton Coal and Land Company, situated on the east side of Similkameen River, near Princeton. The coal is mined by an entry driven on the dip of the seam. The method employed is pillar and room, with the use of coal cutting machines.

Tulameen Platinum Placers.—The principal streams in the district on which platinum bearing gravels have been found are: Tulameen River below Champion Creek; Slate Creek, Granite Creek, Newton Creek. The gravels are post-glacial in origin, and are found in the stream beds and on the sides of the valleys at elevations not greater than 250 feet above the streams. Except in Tulameen River below Slate Creek they are not of very great extent. All the payable gravels contain both gold and platinum, the proportion varying in different streams and in different parts of the same stream. This proportion of gold to platinum varies in the streams mentioned from 4 to 1 to 1 to 1. The source of the platinum has definitely been traced to the elongated peridotite stock which crosses Tulameen River at Eagle Creek and extends south-easterly from there to the head of Newton Creek.

The mining of the platinum placers, which began in 1885, has up to now usually been carried on only by individual miners with the ordinary methods that such men use. Attempts have, however, been made at Eagle Creek, Slate Creek, and Granite Creek to mine by hydraulic methods, but none of these have been very successful. Old workings may be seen at several points on Tulameen River between Slate Creek and Eagle Creek.

The total amount of platinum obtained from the gravels has been variously estimated at 12,000 to 20,000 ounces. The present output, however, is only a few ounces annually.

Tulameen Diamonds.—The diamond bearing rocks are most conveniently seen on the Tulameen River at the mouth of Eagle Creek, 8 miles west of Tulameen Village. The river at this point cuts a valley nearly 3,000 ft. deep, through the middle of a large stock composed of peridotite, pyroxenite and gabbro, which is intrusive in Triassic sediments and volcanics. A vertical section through the stock, given in the accompanying diagram, illustrates the relations of the various rocks to each other. The centre of the stock is composed of peridotite, and this is surrounded on all sides by a border of pyroxenite into which the peridotite passes by a gradual change in composition, the olivine of the one rock being replaced by the pyroxene of the other. Outside the pyroxenite is a thin border of gabbro, which in places passes into an augite syenite. The syenite, however, also occurs in intrusive relation to the pyroxenite. It seems clear that the three rocks were originally present in one common magma, which, in the course of injection into the overlying rocks and while gradually cooling, differentiated into three distinct types, the most basic in the central part and the most acid on the outside.



Section through the ***Nickel Plate Mine.***
showing the relation of the ore bodies to the gabbro intrusives

Chromite occurs in the peridotite in short irregular veins and in bunches, which are clearly segregations developed in the magma during cooling. Analyses made by Mr. R. A. A. Johnston of the Geological Survey of some of these chromite segregations, taken from the north slope of Olivine Mountain, yielded both platinum and diamonds in variable amounts. In making the original analysis the chromite was segregated into two parts, a magnetic and a non-magnetic part.

The non-magnetic part yielded three per cent. of diamond, and the magnetic part six per cent.

The diamond product obtained disintegrated to a powder shortly after being released from the rock, and the disintegrated particles were found on examination under the microscope to be individual crystals. Studied in thin sections, the diamonds were found to occupy small veinlets traversing the chromite.

Since the discoverey of diamonds in the solid rocks the gravels of Tulameen River have been carefully examined. Gravel taken from the river in the neighbourhood of Eagle Creek was panned, and a large number of small diamonds obtained along with the black sand. Small rubies were also found to be present.

Some prospecting for diamonds of commercial size is being carried on in the valley of Tulameen River, but up to the present the results have not been satisfactory. Some diamonds have been obtained, but the largest is not bigger than a pin's head.

Merritt Coal District.—The town of Merritt is situated in Nicola Valley at the junction of Coldwater River with the Nicola. The district lies in the Interior Plateau region into which Nicola River has cut one of those deep, wide valleys, characteristic of the region. The bottom of the valley is about 1,900 feet above sea level, while the surrounding country stands 1,500 feet higher. The country is open or only sparsely timbered, and the slopes, though often steep, are generally covered by a thick mantle of drift.

The oldest rocks of the district are of Triassic age, and belong to the Nicola series. They consist of folded and metamorphosed volcanic flows, and some limestone and argillite. Unconformably above them are the coal-bearing Oligocene rocks which consist of sandstone, conglomerate, shale, and coal. These again are overlaid in places by more recent basaltic flows.

Particular Description.—Like other Oligocene areas in British Columbia the rocks about Merritt are believed to have been deposited in a lake basin and since elevated to their present position. The basin covers a superficial area of about 40 square miles, all of which, however, does not appear to be underlaid by coal. The rocks consist of sandstone, shales, and conglomerates, which dip at angles varying from 10 to 40 degrees. In places the strata have been folded into anticlines, and in others faulted and considerably displaced. They contain a variety of fossil plants from which their age has been determined.

The best natural section of these rocks is that exposed in Coal gully west of the town of Middlesboro. This was measured by G. M. Dawson of the Geological Survey of Canada, and in his report of 1877-78, he gives the following section in descending order:—

	Ft.	in.
Soft yellowish sandstone in thin beds	32	0
Coal, laminated, rather soft	15	4
Sandstone, rather soft, with some shale	89	0
Coal	5	4
Sandstone, with shale at the base	141	0
Coal, about	3	0
Sandstone, in thin beds	136	0
Coal, about	2	5

It is not definitely known how many workable seams of coal are contained within this basin, but there are four outcropping and being worked in the neighbourhood of Coal Gully, and two or three others in adjacent ground to the east, each of which, however, may be correlated with one or another of the four known seams. In the mines of the Nicola Valley Coal & Coke Company these four seams have thicknesses of 6, 10, 5 and 12 feet respectively.

An analysis of a sample of coal taken by R. W. Ells of the Geological Survey and analyzed in the laboratory of the Survey is given below, and probably represents the general character of the coals of this field:

	Per cent.
Water	3.04
Volatile combustible matter	37.18
Fixed carbon	52.05
Ash (reddish white)	7.73
	100.00

Coke, per cent., 59.78. Firm, compact and coherent.

An estimate made by D. B. Dowling of the Geological Survey placed the total quantity of coal in this field at about 200 million tons.

Four companies are actively engaged in mining operations in this field, namely, the Nicola Coal & Coke Company, the Inland Coal & Coke Company, the Diamond Vale Coal & Iron Mines, and the Pacific Coast Collieries. The Inland Coal & Coke Company is producing about 100 tons of coal per day, while the Nicola Valley Coal & Coke Company produces annually about 200,000 tons. Room and pillar is the method of mining employed, and no coal cutting machines are used. The mines give employment to about 400 men.

CONSERVATION OF COAL IN CANADA.

Canada's dependence on the United States for its supply of anthracite coal is a point strikingly indicated in the report just issued by the Commission of Conservation, on the "Conservation of Coal in Canada." Practically all of the most populous portion of Canada lying between Montreal, Que., and Moose Jaw, Sask., relies solely on the United States for its supply of anthracite coal, further, there are indications that the United States may, in the comparatively near future prohibit the export of anthracite, and, as the only anthracite deposits thus far discovered in Canada, are confined to the area near Banff, Alta., it is of great importance that suitable substitutes be found as soon as possible.

Such a situation makes it clear that Canada should carefully husband her coal resources and, so far as possible, check all wasteful methods of mining and handling coal. With this end in view, the report suggests greatly needed changes in the form of coal-mine leases, the provisions of which should be carefully enforced by a competent engineering authority. This would go far towards preventing the careless practices followed at present in many coal mines. In addition to this, it is urged that the government should carry on investigations with a view to determining the suitability of slack and low-grade coals for use in gas producers for generating power, and their adaptability for the manufacture of briquettes for domestic use. By utilizing these inferior products in this way, not only would there be less waste, but the value of the public coal lands would be considerably increased.

Again, it is pointed out that central power stations situated in the vicinity of many of the lignite fields of Western Canada, could develop electric power for transmission to neighboring manufacturing centres. This would mean a great saving, especially in the case of lignites that will not stand shipping to any considerable distance.

The experience of Great Britain, the United States and other countries in the manufacture of coal bri-

quettes is given in some detail, and the method adapted to conditons in Canada are indicated.

Comparisons are made between the bee-hive ovens and the by product ovens for the coking of coal and the economies effected by the latter over the former are clearly presented.

In addition, short descriptions are given of the principal coal mines in Canada, as well as of the by-product coke oven plant of the Algoma Steel Co., at Sault Ste. Marie, Ont. The report is well illstrated by means of maps, diagrammatic sketches and halftone engravings, and should prove of great value, not only to those directly engaged in coal mining, but to all who are interested in the economic welfare of the Dominion.

F. AUGUST HEINZE TAXATION CASE.

On March 12 Mr. R. S. Lennie, a special judge of the Court of Revision, sitting at Nelson, British Columbia, heard arguments by counsel for Mr. F. August Heinze and for the Government of British Columbia in a matter the chief point at issue in which is whether the Province of British Columbia has any right to tax Mr. Heinze on 307,800 acres of land in Kootenay and Boundary districts comprised in tracts representing one-half of the original land subsidy to the Columbia & Western railway from Trail, in Kootenay, westward to Midway, in Boundary district.

Under an agreement, dated February 11, 1898, between Mr. R. B. Angus and Sir Thomas Shaughnessy, representing the Canadian Pacific Railway Co., on one side, and Mr. F. August Heinze, on the other, the latter agreed to sell to the former the Columbia & Western railway (then partly constructed), smelting works at Trail erected and for several years operated by Mr. Heinze, and other interests, for $800,000 and a one-half share in the Columbia & Western railway land grant from the Government as subsidy for the construction of the railway, but with a provision which gave Mr. Heinze the privilege of asking for possession of his share of the land whenever he should please to do so. Later the C. P. R. brought action in the Supreme Court of Canada against Mr. Heinze to compel him to select his half of the land, but failed, for the court found that partition could not be enforced and declared that none of the parties to the agreement of 1898—Messrs. Angus and Shaughnessy on the one hand and Mr. Heinze on the other—had any legal or equitable title to the land, the entire title being vested in the Columbia & Western Railway. In 1912 the Government of British Columbia agreed to purchase from that railway (which had meanwhile become a part of the Canadian Pacific system), the whole land grant, subject to the interest held by Heinze.

Lengthy arguments were submitted to the special judge, who declined to allow Mr. Heinze's appeal against the tax assessment of $12,312 annually levied by the Government. Counsel for the Government stated that the position of the Crown is simply that the agreement under which Mr. Heinze still holds a one-half interest in the land "was a faked-up transaction to save Mr. Heinze from paying taxes. It would be a travesty on justice if by such a transparent dodge Heinze could escape taxation."

Mr. Heinze will carry his appeal to the Privy Council.

WESTERN FEDERATION CALLS OFF STRIKE IN MICHIGAN

(Houghton Mining Gazette.)

The strike of the Western Federation of Miners was voted off by a referendum of the strikers Sunday, April 14. This vote was canvassed by the district board at a meeting at Hancock yesterday. At the close of this session yesterday afternoon Secretary Hietela gave out the following statement:

"To whom it may concern: Complying with instructions of the district board, it was decided not to give any separate figures from each of the local unions. Total vote cast in favor of calling off the strike throughout the district, 3,104; total vote cast in favor of continuing the strike, 1,636; total vote, 4,740."

There was no explanataion of the reason for not giving out official details and there were open doubts expressed among many of the strikers last night as to the correctness of the figures.

While the assumption was general on Sunday evening that the vote favored calling the strike off, the news that the referendum ends the only general strike the Lake Superior copper mining district has known in its long history was received with general satisfaction all over the copper country. Rejoicing was evident among all classes of people, the strikers more particularly, for it is generally known that the majority of them have all along wanted only the opportunity to express their desire to return to work. On every hand could be heard expressions of get-together sentiment and general inclination to help the strikers to get on their feet again.

Notwithstanding the official totals as given out by the strike leaders, the following table is generally accepted by those closely watching the strike as being accurate:

On the question of calling off the strike:

	For.	Against.
South Range	495	93
Calumet	281	391
Ahmeek	600	72
Hancock	365	255
Mass.	121	56
Total.	1,762	867

Secretary Hietela said on Sunday that he expected 8,000 votes, and he said yesterday that the vote was light. Observers of strike affairs in the several months past are of the belief that the vote was heavy. This gives nearly 3,000 active strikers, and there has been a doubt for months of even that strength.

Strikers Clamor for Work.

The stampede of the strikers began long before the vote even was begun. They were seeking work Saturday and all day yesterday they were at the mine offices looking for their old jobs. Reports from the offices indicate that 50 applied at Painesdale, 100 at Baltic, 75 at Trimountain, 150 at Quiney, 300 at Ahmeek, Mowhawk, Wolverine and the Calumet and Hecla properties.

At Quincy, Mohawk and Ahmeek a small proportion were given work at once. Quincy put on a considerable number in fact, and Ahmeek had 100 places open and they were filled. Mohawk and Wolvervine will give the men work gradually as places can be found for them.

The policy of the Calumet & Hecla, announced by General Manager MacNaughton about two weeks ago, will be followed generally by all the companies. This is to take the names of the men who apply, each applicant being required to turn in his union card. As soon as work is found, the men will be selected from the listed applicants.

General Superintendent Knox of the Calumet & Hecla announced to the men yesterday that no work would be given to men from the outside, that the preference would in future be given to former employes.

The Tamarack is the only large property in the district that has not resumed operations. General Manager MacNaughton of the Calumet & Hecla, of which company the Tamarack is a subsidiary, is now in the east. The question of the resumption of the Tamarack will not be answered till his return. The mine will offer employment to about 1,000 men and with the numbers taken on at other mines the unemployed represented in the vote of Sunday probably will be taken care of almost wholly.

It is true that there are a few marked men in the district who will not be given work. These are men who have been concerned in violence, or who have helped to prolong the industrial discontent by reason of their inflammatory agitations. But this number is comparatively few.

Secretary Hietela says that any member of the Western Federation who cannot find work will be given money to get out of the district, but that this will apply only to men who cannot get work, not to men who will not work or who want to move on for the sake of moving.

Secretary Hietela says that various local headquarters of the Western Federation of Miners in the copper country will be closed at once, excepting the Hancock headquarters.

This strike and its failure, accompanied by the bitterest, most crushing and most complete defeat ever administered the Western Federation of Miners, one of the worst defeats ever gained over any body of organized labor, completely discredits the Western Federation of Miners throughout the labor world, in the opinion of copper country people. The federation has won but very few strikes and no important strikes in all its history of bloodshed and violence. Its history is a history of failures, mixed with murders of men, women and children, dynamitings, arson outrages, rapine, thievery and graft. It is officered practically by the same men to-day who controlled its early destinies.

Editorial Comments on the Michigan Strike.

Houghton Mining Gazette: Well, the great copper strike is off, officially off, nine months after it started. As soon as the strikers themselves had a chance to vote on it they declared themselves in favor of returning to work. Now the situation that confronts the mines of the district is to find places for the strikers. There is an oversupply of workmen.

In addition to the millions that the strike cost the strikers in loss of wages, the maintenance of the strike has required just about $1,000,000 to finance. Most of this money came from the American Federation of Labor and from honest workingmen who were misled into liberal contributions to the cause of the strike by the misrepresentations in the newspapers and by the paid orators who did the collecting for the strike. The representatives of the American Federation of Labor who were at intervals in charge of the strike, never believed it could win. Neither did the American Federation of Labor countenance the strike. They simply made the best of a bad situation when they found that they could not help themselves.

When the strike started the Western Federation of Miners had but $75,000 in the treasury. That money went rapidly. Then a loan of $100,000 was secured from the United Mine Workers of Illinois. That deal was framed between Moyer and Walker, the same Walker who openly advocated murder on the platform at the Indianapolis meeting of the United Mine Workers. Another little loan of $25,000 was secured from a brewery union in Cincinnati. In actual cash contributions through the regular channels, the American Federation of Labor sent by far the larger sums, $250,000 in all. And over $200,000, it is estimated, came from various unions, straight to the strike managers, from various and divers locals affiliated with the American Federation of Labor. The strike cost the Butte union of the Western Federation more than any other organization, for that union is fat and rich and pays regularly. The average cost per member to the miner in Butte was $25. In one month, through the regular assessment of a day's wages and by various contributions on the side the Butte contribution to the strike managers was $80,000.

And now, nine months after the red socialists and the paid agitators succeeded in bringing about a period of riot and disorder, Mr. Mahoney, Mr. Miller, Mr. Tersich, Mr. Lowney and the others are nowhere to be seen. The men were permitted, finally, to vote their strike off. But none of the paid agitators are here to help them to secure jobs. The experience has been costly for the mining companies and more costly for the strikers. It has taught them not to believe the paid agitators. The chap who lives off the working men, who has his champagne dinners while the striker manages to get along on three dollars a week, is nowhere to be seen. He is in some other mining district now, doing the same tricks. He is somewhere else trying to stir up trouble. He is in a new field trying to bring about a strike. He quietly folded his tent and stole away into the dark night, just as soon as he saw that the inflow of money hesitated.

The fact, too, is generally acknowledged, that President Gompers of the American Federation of Labor did not desire a Congressional investigation and refused, at first, to favor such a step. But Moyer and Walker by their conduct and attacks on Gompers, at the Indianapolis convention, put Gompers in such a position that he had to do their bidding in this regard, and when he asked his lobby at Washington to see that the Congressional committee investigated the strike, action was secured without delay. The committee has not yet reported.

All of the mass of claims that the foreign agitators circulated among the strikers have proven untrue. The strikers believed the agitators when the strike started. Promise after promise was broken. Before the strike started the men were led to believe that $1 a day benefits would be paid. Perhaps the most insidious lie that was circulated referred to Government ownership. The men were told that the Government would take over the mines and employ none but Federation workingmen. When Secretary Wilson of the Cabinet of the President made his speech at Seattle advocating Government ownership, this was utilized for the purpose of proving the claims of the agitators. Then it was promised that Wilson himself would come and take charge of the mines. That was held out for weeks as a bait. Then when the Congressional committee arrived and spent a month here, the very presence of the Congressmen was used by the strike leaders as evidence of Federal assumption of mine management. And some politicians seemed willing and anxious to participate in this misrepresentation of the situation.

Officially declaring the strike off, while it has, practically, been off, in effect, for some months, is a good thing and will clear the atmosphere. It means a more prosperous copper country. It means a larger working force at all of the mines than ever before in the history

of the district. It means higher wages for all of the men and it means greater efficiency in every way.

Ishpeming Iron Ore: While the strike in the Michigan copper district was over several months ago so far as the mining companies were concerned, the Western Federation voted on ending or continuing it, Sunday, with the result that it was practically unanimously agreed to call it off. It was a foregone conclusion. There were a number of Finn farmers, who came in from the country surrounding the mining towns, these protesting by their votes against the ending of the strike officially. They had been drawing money from the federation and marching boldly with the miners for months. Their interest was easily seen. There were also a number of men in other vocations than mining, some of them being mere loafers, who also protested against the movement to end the strike. And then there was a considerable number who knew they could not get back into the mines anyhow, and these desired the continuance of the strike benefits. For several days before the vote was taken the men knew what the result would be. The federation desired to get away from the expense. The copper country strike had cost their organization not far from a million dollars, and there wasn't the ghost of a show of winning. Many men, knowing the benefit rate was to be cut savagely, or taken away altogether, tore up their cards and sought employment at the mine offices.

And so it has ended. It didn't help the copper miners, or the federation or the mining organizations or the district generally. It injured everyone concerned in it directly or indirectly with the exception of the organizers and money handlers. These fellows did exceedingly well.

And the finish finds many men out of employment who will not be able to get back into the mines where they used to win good wages. They have been so bitter and unreasonable, so defiant of law and order, so un-American and altogether so undesirable that they cannot hope for reinstatement in their old jobs. These men will have to leave the Michigan copper country for that country's good. They will have to seek employment elsewhere and, if they succeed in getting it, their experience in Michigan may be valuable to them in showing them the error of their ways and in making them better citizens. The copper country is fast building up to its old-time activity and output of the red metal. It is a good country, fair to men, and with many advantages not possessed by some other mining fields. It will soon be back into its old stride and will have learned something from the experiences of the past half year that will be valuable in the years to come. The Western Federation will have gained some late information, too, on the subject of recognition of its body. It has discovered that there is yet another place it cannot dominate through a reign of terror, through murder and arson, or through any of the tactics it has always employed. It has found one district with a real backbone where the Stars and Stripes wave high and triumphantly over the red rag of anarchy, and where the spirit of independence is still alive and doing business.

Detroit Free Press: The strike, as an industrial weapon, has been badly discredited by the outcome of the copper country's lamentable disturbances. Estimates of the cost of this prolonged struggle are that the mine owners are out of pocket some four million dollars, the strikers a million in wages, the federation another million in strike benefits and Governments, county, state and federal, something like $700,000. The figures are probably high—so far as the mine owners are concerned, mining being a peculiar business and decreased output not necessarily representing ultimate loss as the ore unextracted remains to be marketed later. But allowing for all possible defects in the calculations the expense of this strike has been very great.

It is a question whether any strike is good business policy, regarded from the point of view of the public which must bear the cost of all industrial operations in the end, and upon which the added waste of these struggles falls harshly, but in this instance very much of the loss has no excuse whatever for existence. The copper strike has been prolonged months beyond the time when it could possibly effect any result. The issues had narrowed down last fall to the single dispute over recognition of the federation, and as to this everybody concerned agreed long ago that there was absolutely no chance for getting together. That the owners would not recognize the federation under any circumstances has been reported time and again by the investigators of the disturbance, and the inevitable might as well have been accepted last October as now. All the loss that has accrued in the meanwhile, whether to employers or employees, has been inexcusable.

If this added waste was caused by the impossibility of bringing the dispute to a termination earlier, the fact is all the more a reflection on the value of the strike as a weapon. It is a very poor implement that is so difficult to control, and in these times of seeking after efficiency it ought to be abandoned speedily and some better substitute found for settling differences. If the prolongation of the hopeless struggle was the deliberate work of interested leaders it is highly discreditable to them, and the more convincing an argument against the character of the organization which inaugurated this futile and costly warfare.

Michigan's experience with the Western Federation of Miners has been anything but agreeable. Without approving all that the mine owners stand for, the people of the state will generally be pleased that the federation has lost and will trust that it has been driven out for a very long time.

General sympathy will be felt for the dupes of the federation agents, the men who put their trust in it and who have been left by it to clamber out of their difficulties as best they may. The mines will take back as many of them as possible, no doubt, but there will be many sufferers.

Detroit News: The strike illustrates the ease with which workingmen of foreign extraction are imposed upon by the most worthless representatives of organized labor. The Western Federation and the I. W. W. fatten on the ignorance of aliens whose notions of conditions in America are sadly distorted and whose anti-governmental sentiments, still alive from the injustices of other lands, are ready to flare into flame under the misrepresentations of ignorant and anarchistic agitators.

The Daily News, Nelson, B.C., states that Mr. R. F. Green, M.P. for Kootenay district, has informed the president of the Nelson Board of Trade that an appropriation sufficient to carry to completion the experiments in electric smelting of lead-zinc ores, now being conducted at Nelson by the Mines Branch of the Canada Department of Mines, will be provided for in the Dominion Finance Minister's supplementary estimates. Mr. W. R. Ingalls, of New York City, who is consulting engineer to the Mines Branch in connection with the zinc-smelting investigations, was at Nelson about the middle of April.

BY-PRODUCT COKE OVENS.

Canada and the United States are far behind Germany and other foreign countries in realizing the economies resulting from the coking of coal in by-product ovens. In Germany, at the present time, little or no coke is made in retort (by-product) ovens. When the economies which may be effected by the use of such ovens have been so clearly demonstrated, not only by plants which have been constructed in Europe, but also by plants at Sydney and Sault Ste. Marie in Canada, and in the United States, it is difficult to understand why they are not more generally adopted in Western Canada. No doubt the greater cost of installing them, and the lack of markets for the resultant by-products have hindered progress in this direction in the past. The development of the West, however, is rapidly creating local markets for the products, and in view of the higher yield the greater initial cost should no longer be a deterrent.

The following are some of the economies which may be effected by the use of by-product coke ovens as against the use of beehive ovens:

1. The quality of the coke is just as good for metallurgical purposes as coke made in beehive ovens.

2. The yield of coke from by-product ovens is from 10 to 15 per cent. higher than the yield from bechive ovens.

3. While the cost of installation per oven is greater for the by-product than for the beehive oven, the capacity is from three to six times as great.

4. In the by-product ovens the following by-products are saved:

Gas.—Coke oven gas is an ideal fuel and may be used for burning under boilers, driving gas engines, for domestic purposes and illumination.

Ammonia.—The ammonia may be recovered as ammonium sulphate or ammoniacal liquor. In the former case it is used as a fertilizer, while, in the latter, it can be used for making many chemical products and also as the freezing agent for refrigeration purposes.

Tar.—The tar may be used in the manufacture of various kinds of roofing, for covering pipes, etc. It can be distilled, yielding pitch, creosote, light oils, carbolic acid, etc. Creosote is especially useful as a wood preservative. Pitch is used for road making and as a binder for the manufacture of coal briquettes.

Fuller information on this important subject can be obtained by persons interested from a report entitled "Conservation of Coal in Canada," by W. J. Dick, M.Sc., recently published by the Commission of Conservation.

WESTERN RAILWAY RATES.

The Canada Railway Commission, after having taken all available evidence relative to freight rates charged by railways in the Canadian West and given the question close consideration, has made a lengthy report in which many changes in rates are announced. The rate on pig iron from Port Arthur and Fort William to Winnipeg is reduced from 20 cents per 100 lb. to $3 per gross ton or approximately 13.4 cents per 100 lb. Ores, concentrates, and smeltery products in and from British Columbia have been found to constitute a large proportion of the railway freight traffic of that Province, and the rates in force are remunerative only in the sense of contributing to the general prosperity. Reductions are made in rates for coal from mines in Manitoba, Saskatchewan, Alberta, and British Columbia to a number of specified market points.

BOOK REVIEWS

LINDLEY ON MINES—By Hon. Curtis H. Lindley, of the San Francisco Bar—A Third, New Edition, 1914—Three Volumes, Buckram—Price, $25.00.

The first edition of this masterly treatise on the American law of mines and mining was issued in November, 1898. The sale was immediate and remarkable, resulting in the entire edition being exhausted in less than two years. The second edition, published in 1903, met with even greater favor, and it was not long before the then available stock was sold out.

The new edition not only faithfully develops and brings down to the present moment with authorities, the text of the earlier work, but presents to the American Bar the first philosophical text discussion of many new, vital questions that have arisen only within the last few years, with close practical analysis of related legislative enactments and regulations, including a discussion of pertinent adjudications.

The new chapters include a complete review of the recent U. S. policy of "Withdrawal of Mineral Lands," defining the legal effect of "Executive and Ballinger Withdrawals" and of the "Congressional Withdrawals" following.

The third edition includes an enlarged special treatment of "Public Land Classification," agricultural as well as mineral, the latter embracing, among others, special enactments, regulations and decisions covering coal lands, oil lands, phosphate lands, potash deposits, etc. Particular attention is devoted to the important "Alaskan Problems," including recent U. S. and territorial legislative enactments affecting mining of the Alaskan coal lands.

Not only will the work be of special value to all lawyers interested in mining laws, but will be of practical service to mining engineers. It takes up the geological problems related to mining as raised in litigation, and which have reference to the question of "Title to Mines." The problems related to "Extralateral Rights" have been given full attention, with an analytical treatment of "Rights on Secondary Veins."

A complete table of cases gives ready access to the many cases cited. Over a thousand new cases have been fully analyzed, discussed, cited and included as new matter in the third edition.

THE MINING WORLD INDEX OF CURRENT LITERATURE—Last Half Year 1913—By Geo. E. Sisley, Associate Editor Mining and Engineering World—Published by Mining World Co., Chicago—Price $2.00—For sale by Book Department Canadian Mining Journal.

The fourth volume of this very useful publication, like previous volumes, covers the world's literature on mining, metallurgy and kindred subjects, and embraces all references of importance to the literature of the field it represents.

In the Mining World Index of Current Literature are classified all articles appearing in periodical magazines published in America, Europe, Africa and Australia on mining, mining engineering, metallurgy, mining geology, mineralogy, etc.; also the valuable publications of the world's mineral industries, institutes and affiliated engineering and technical societies, as well as publications of the Federal and State geological surveys and mining bureaus. All these are indexed by a simple plan, easily understood.

To all who have frequent occasion to refer to current literature, the Mining World Index has become a necessity. We recommend it to our readers.

PERSONAL AND GENERAL

Mr. A. McKnight, who died recently at San Diego, California, whence he had gone in the hope that the change of climate would benefit his health, was for years master mechanic at the Union Colliery Co.'s coal mines, Comox district, Vancouver island, B.C. Later he filled a similar position at the Britannia Mining and Smelting Co.'s smelting works at Crofton, also on Vancouver island, and during quite recent years he had charge of all mechanical equipment at the Britannia Co.'s copper mines and concentrating works near Howe sound, in Vancouver mining division, B.C. He was born in Scotland 66 years ago, and went to British Columbia in 1884.

Mr. Geo. Watkin Evans, of Seattle, Washington, who some time ago examined and reported on coal areas in the Groundhog field, northern Skeena district, B.C., and has since been to the Matanuska field, Alaska, superintending mining coal for a thorough test on one of the United States Navy ships, was among the visitors who took part in the meeting of the Western Branch of the Canadian Mining Institute, held on Feb. 19, in Vancouver, B.C.

Mr. J. W. Powell, formerly of Coleman and Bellevue, Alberta, and afterward with the Columbia Coal and Coke Co. in the Tulameen country, British Columbia, is now superintendent for the Cottonwood Coal Co. at Windham, Montana.

Mr. A. H. Gracey, of Nelson, B.C., who has for some time past been developing the Venus gold mine at a lower level than had been worked in past years, has been on a visit to California.

Mr. C. R. Hamilton, K.C., who in the capacity of a special commissioner, took much evidence in the case of Wm. Wilson, overman at one of the Coal Creek Colliery mines of the Crow's Nest Pass Coal Co., has suspended Wilson's certificate for four months, having found proved the charge of gross negligence on the part of Wilson in permitting the use of a defective haulage cable, the breaking of which resulted in the death of a miner.

Mr. John Hunt is now general superintendent of the Western Fuel Co.'s several coal mines in the neighborhood of Nanaimo, Vancouver Island, B.C., for which company Mr. Thomas R. Stockett has for years been general manager.

Mr. L. Muller, superintendent of Mr. John Hopp's hydraulic placer-gold mines in Cariboo district of British Columbia, has returned to Barkerville, Cariboo, after having spent part of the winter in California.

Mr. E. H. Nutter, of San Francisco, chief engineer for the Minerals Separation American Syndicate, was at the concentrating mill of the Silverton Mines, Ltd., on Four-mile creek, Slocan, B.C., recently, in connection with turning over to the company a flotation process plant the syndicate had put in and had been operating until all necessary adjustments had been made.

Dr. J. Bonsall Porter, professor of mining engineering at McGill University, Montreal, has arranged for his summer mining school to visit Nelson and Rossland in West Kootenay, and Phoenix in Boundary district, British Columbia, during May.

Mr. J. M. Ruffner, general manager for the North Columbia Gold Mining Co., operating in Atlin camp, British Columbia, while in the Eastern States some time ago, organized a company to work placer-gold ground on O'Donnell river, Atlin district, along which much ground has been taken up during the last two years.

Mr. Chas. H. Palmer, Jun., of Los Angeles, California, has been examining the Hartney mining property, near New Denver, Slocan lake, B.C., for United States people interested in it.

Mr. Neil J. Ogilvie, of Ottawa, who spent the last three field-work seasons on the Alaska-Yukon boundary survey, went to the Pacific coast last month on his return to Yukon Territory. It is expected that the boundary survey will be completed this year.

Mr. B. A. Stimmel, chief chemist at the Consolidated Mining and Smelting Co's smelting works at Trail, B. C., has been away for a short time on a vacation.

Mr. J. J. Streit, of Whitewater, B.C., superintendent of the John L. Retallack & Co.'s group of mines, has been taken to Rochester, Minn., to there obtain special surgical treatment.

Mr. J. T. Towers, who last season had charge of test drilling on Big Valley creek, Cariboo, B.C., has returned to that district and will this year direct drilling operations on the Williams Creek flats to determine whether there is sufficient gold-bearing gravel there to warrant a gold dredge being put in to recover the gold.

Mr. Harry H. Yuill (B.Sc., with British Association medal, McGill, 1909), is now in South Africa in charge of important mining operations.

Mr. Chester F. Lee, of Seattle, Washington, recently visited the Similkameen, B.C., a second time to examine placer-gold ground along the Similkameen river, above the town of Princeton.

The Western Branch of the Canadian Mining Institute will hold a meeting in Nelson, B.C., during the latter half of May. The organization meeting of that branch was held in Nelson in January, 1908, so that the branch has been in active existence six years.

A meeting of the Toronto branch of the Canadian Mining Institute was held on Saturday, April 18.

Mr. C. F. Cretney is in charge of operations at the Jupiter mine, which has been reopened by the McKinley-Darragh-Savage Mining Company.

Mr. G. G. S. Lindsey, president of the Canadian Mining Institute, has returned to Toronto after attending the annual meeting of the Nova Scotia Mining Society at Sydney.

Mr. George H. Garrey wishes to announce that he recently severed his connection with the American Smelting & Refining Co., and allied companies, as their chief geologist, and has opened an office as consulting mining geologist and engineer at 115 Broadway, New York.

Mr. F. F. Combemale has joined the staff at Cordova mine, Cordova, Ont. Mr. Combemale is a mining engineer of wide experience, who has spent considerable time in Venezuela.

Mr. Frank Oliver has accepted the position of assistant manager at Cordova mine.

On April 9th, M. Beatty & Sons, Welland, launched a dipped dredge for the C. S. Boone Dredging & Construction Company of Toronto. This dredge is of steel, 100 ft. long, 40 ft. wide 10 ft. deep at bow, and 8 ft. at stern. It is of the crane type the crane being 40 ft. long. The dipper is of 5 cubic yards capacity, the dipper handle is 61 ft. long, which will allow it to make 40 ft. of water.

Mr. C. C. Mendham who has been connected with the outdoor staff in Toronto of the Herbert Morris Crane & Hoist Company Limited, has now been appointed Resident Engineer in Berlin for the same company

The 108th meeting of the American Institute of Mining Engineers will be held at Salt Lake City, Utah, August 10-14, 1914.

The Northern Electric Co., has issued a bulletin describing low voltage lighting outfits suitable for installation in places remote from the territory covered by central station power lines.

OBITUARY.

Thomas Starbird, who died at Wilmer, East Kootenay, B.C., on April 12, was born in Maine, and during his boyhood lived in Haverhill, Massachusetts. In later years he lived at Great Falls, Montana. Ten or eleven years ago he was manager of the property formerly known as the McDonald mines, but acquired by a syndicate of Eastern United States men, who operated in East Kootenay, under the name of the Ptarmigan Mines of the Selkirks. The Ptarmigan mine has been inactive about nine years, owing to lack of transportation facilities. Mr. Starbird, however, took up land and remained in the district ever since, where he was well and favorably known. He has left a widow and two young sons.

The Westinghouse Electric & Manufacturing Co. reports a number of important orders recently received from the metal mining industry, indicating lively activity along the line of metal mining. The following are among the more important orders received:

United Verde Copper Co., Jerome, Ariz., one 24 panel switchboard for the new smelter at Clarkdale; El Paso (Texas) Smelting Company, two 55 h.p. direct-current back-geared motors for operating Stillwell Pierce converters; Magna Copper Co., Superior, Ariz., nine A. C. squirrel-cage motors, totalling 267 h.p. and 90 k.v.a. transformer capacity for operating copper concentrating mill being built by the General Engineering Company. An interesting point in connection with this installation is that the energy for operating the motors will be supplied from the Roosevelt Dam Power project. Anaconda (Mont.) Copper Mining Co., six 150 k.v.a. oil-insulated, self-cooling transformers for the Washoe Smelter; also 14 A. C. motors totaling 290 h.p. for driving mine ventilating fans. National Copper Mining Co., Wallace, Idaho, one 4-ton barsteel locomotive for tandem operation with a locomotive previously purchased. Utah Copper Co., Magna, Utah, four 15 h.p. slow-speed vertical D. C. motors for direct connection to agitators used in oil flotation process. This is a new application especially developed by the Westinghouse Elec. and Mfg. Co., after considerable experimentation; also two 50 kw. motor generator sets with switchboards; and three 100 kw. transformers. Alaska Gastineau Mining Co., Juneau, Alaska, two 18-ton barsteel locomotives for underground and surface haulage. This locomotive is especially designed for a low height in order to permit them entering the mine. Kennecott (Alaska) Mines Co., one 50 h.p. back-geared A.C. motor and three 25 k.v.a. transformers. Alaska Juneau (Janeau, Alaska) Mining Company; one 5½-ton storage battery locomotive for 30-inch gauge equipped with two V-50 motors and 68 cells of A-10 battery. Mason Valley Mines Co., Thompson, Nevada, two 15 h.p. D.C. back-geared motors with brakes, controllers and resistors, for use in ladle tilting in copper smelter. Tonopah Belmont Co., Tonopah, Nevada, one 75 h. p. A.C. motor used for driving an Aldrich pump. Brunswick Consolidated Gold Mining Company, Grass Valley, Cal., three 100 k.v.a. oil-insulated, self-cooled transformers.

BRITISH COLUMBIA.

It is customary for one of the members of the Government to deliver an address at the annual meeting of the Victoria, British Columbia, Board of Trade. This year the duty was undertaken by Hon. W. J. Bowser, Attorney-General for the Province. In the course of a carefully-prepared and well-received address, which was an interesting and valuable survey of the resources and progress of British Columbia, he made brief reference to iron manufacture, and to the mining industry of the Province, as under:

"My opinion is that in British Columbia we are making very substantial, almost rapid, progress in our industries, and we may be sure that capital, which is always looking for profitable investment, will seize upon any favorable opening as soon as it presents itself. Take the iron industry, for instance. A great many people wonder why, with our immense accessible deposits of iron ore and many other natural advantages for the manufacture of iron and steel, we have no blast furnaces. I am told that it is not altogether the price of labor or the lack of material that accounts for this, but that it is the price of fuel, or, in other words, the cost of producing coke, which is three or four times that on the Atlantic side. I am also told, however, that the electrolytic system of smelting, by the use of water-power is being rapidly developed in certain countries in Europe, and that by the new processes it is possible here to establish a small and paying industry with comparatively limited capital. Thorough investigation along these lines should be well worthy of the serious attention of our Boards of Trade.

"I need not refer at length to the mining industry. It is now on a well-established basis, producing steadily and in a substantially increasing ratio year by year. Its problems have, as the result of years of experience, been largely solved, and the policy of our Premier, the Minister of Mines, has been to carefully and justly administer his Department with as little change of laws or regulations as possible, and the result has been satisfactory in the extreme. The revenue of the Province from mining during the current fiscal year, exclusive of the tax on coal lands, is estimated at $580,000, an amount likely to be considerably exceeded, which is a fair return from the industry involving so much capital, representing as it does more than 25 per cent. of the dividends paid to mine operators."

A definite announcement has been published to the effect that the Northern Navigation Co., one of the most important corporations operating in Alaskan and Yukon waters, has sold its steamers, barges, and terminal facilities to the American Yukon Navigation Co., and the latter will continue to transact the transportation business to all points on Yukon river and its tributaries. The Northern Navigation Co., which was controlled in San Francisco, California, operated 43 steamers and 54 barges, and owned terminal facilities in Alaska. The American Yukon Navigation Co. is stated to be backed largely by English capital, and to be part of a big organization which includes the White Pass and Yukon Route, owning and operating the railway from Skagway, at the head of Lynn canal, to Whitehorse, in Southern Yukon, and steamers and winter stage lines thence to Dawson.

Granite from a quarry near Nelson, B.C., is being used in the erection of a Mormon temple at Cardston, Southern Alberta.

YUKON.

Dr. Alfred Thompson, member of the Canadian House of Commons for Yukon Territory, recently presented H.R.H. the Duke of Connaught, Governor-General of Canada, with an invitation from the Arctic Brotherhood, Dawson, to visit the Yukon next summer. Accompanying the invitation, which was written on caribou skin and enclosed in a gold sack, was a beautiful lamp made for the Brotherhood by a Dawson lady artist, Miss Ogburn. The lamp is triangular in shape and is made of caribou skin decorated with designs peculiar to the Arctic region. On the upper part of the lamp are a gold pan, pick and shovel, emblems of the Arctic Brotherhood, with real gold nuggets being poured from the pan. On the sides of the lamp are photographs illustrative of scenes in the North—the midnight sun, aurora borealis, a garden in Dawson in summer, a steamboat passing through Five Finger rapids on Yukon river, a train on the White Pass-Yukon railway, and a view of the city of Dawson, the whole having a most picturesque effect. On one side of the lamp is burnt a verse from one of Service's poems descriptive of the Yukon. His Royal Highness expressed himself as being delighted with the present, and requested Dr. Thompson to convey the members of the Arctic Brotherhood his warmest thanks for their invitation, which, however, he keenly regretted he could not at present accept, since he would not be able to visit the Yukon during the current year.

BEAVER LAKE.

A press despatch from Prince Albert, Saskatchewan, states that approximately 500 mineral claims had been staked by the middle of April at Beaver lake since public attention was several months ago turned to that part of the Province as a promising field for gold. On Saturday, April 11, registrations of 104 locations of claims were made at the Dominion Land Office, Prince Albert, which number constituted a record for any one day, but lately the rush to the field has been such that it is expected that record will soon be surpassed.

ONTARIO MAGNETITE ORE DEPOSITS.

The Iron Trade Review in its March 12 issue says: Recently there has been offered to the iron interests a proposition which on the face of it appears to be exceedingly interesting. It relates to a reported deposit of magnetite in Ontario near Sunridge, north of Parry Sound. The deposit is included in an area recently acquired by certain Pennsylvania interests. It has been test-pitted to some extent and about a year ago some drills were used in the exploration of the property. The owners now come forward with a claimed tonnage of 100,000,000 tons and submit several assays to indicate that the ore will run 60 per cent. in iron. It has long been known that there were deposits of magnetite in that locality, some of which have been considered of commercial importance, but none of the information which has been made public up to this time indicated any figures within a long range of these claims. The property has been examined several times within the past few months by representatives of large iron ore users and recently it has been reported that a Pittsburgh company had made an offer for the property after a preliminary examination. The deposit is near one railroad and could be easily transported to a deep water harbor on Georgian Bay and thus become available for distribution at lower lake ports. It will be interesting to watch the verification of the claims in regard to this property and particularly in view of the fact that, if it is of large magnitude, it will be a factor in supplying the American and Canadian market and will have some advantage in a shortened lake transportation haul over any of the deposits in the Lake Superior country.

DOMINION ASSAY OFFICE, VANCOUVER, B.C.

The quantity of gold contained in 783 lots received at the Dominion Assay Office, Vancouver, during the calendar year 1913 was 111,479.95 oz.; net value was $1,448,625.37. Corresponding figures from five earlier years follow: In 1912, 527 lots, 59,068.83 oz., $974,077.14; in 1911, 442 lots, 39,784.70 oz., $647,416.38; in 1910, 490 lots, 46,064.31 oz., $746,101.92; in 1909, 573 lots, 48,478.60 oz., $789,267.94; in 1908 (nine months), 590 lots, 90,175.48 oz., $1,478,893.74. It will be seen that the last mentioned year, or rather nine months' period, was the only one in which the receipts for 1913 were exceeded. Going back to the first year on record —the fiscal year 1901-1902—the gold receipts were generally comparatively small, the chief exceptions having been a value of $1,153,014.50 in 1901-1902, and $751,693.97 in 1907-1908 fiscal year. It is still the custom to send the gold received at the Dominion Assay Office in Vancouver to the United States Assay Office in Seattle, Washington, and not to the branch of the Royal Mint at Ottawa.

ALGOMA STEEL CORPORATION.

Sault Ste. Marie, Ont.

Mr. J. Frater Taylor, president of the Lake Superior Corporation, in a statement regarding the increase in the iron and steel duties, says:

"The changes will benefit the industry as a whole, but in our specific case, that is the case of the Algoma Steel Corporation, the promise of definite assistance in the manufacture of the larger sizes of structural steel is a decisive step forward and will enable the Algoma Steel Corporation to immediately progress with its plans for the installation of a heavy structural mill of large capacity. This has been contemplated for some time and now that protection is afforded in respect of rolled sections over 35 pounds a yard there is some incentive to our taking the necessary steps to mature our plans and to arrange our finances.

"Nothing definite has been done in the matter of encouraging mining of iron ore, but an investigation is promised and it is hoped that this will bear fruit."—Financial Times.

MAP OF WHITE RIVER & CHISANA DISTRICTS.

The Geological Survey of Canada has just published a map showing Canadian routes to White River district, Yukon, and to Chisana district, Alaska. The map shows waggon roads, Government trails, navigable water routes and winter routes, rough trails, winter roads and road houses. The map shows the road from Whitehorse to Dawson, the road from Whitehorse to Kluane and the trails from Kluane, Dawson and Fort Selkirk to the White River and Chisana districts.

CORDOVA MINE.

Mr. P. Kirkegaard announces that the Cordova mine, Peterboro, Ont., will soon be in operation. Financial assistance has been secured and the litigation brought about by differences among the owners has been disposed of.

SPECIAL CORRESPONDENCE

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

The Hollinger four weekly report for March 25 shows that there was again an increase in the gross profit, although the value per ton was considerably lower, but on the other hand costs were lower by about a dollar a ton. The periods March 25 and February 25 compare as follows:

	Feb. 25	March 25.
Gross profit	$11,679.60	$121,641.23
Net surplus	721.805.68	753,446.91
Total costs per ton..	5.518	4.328
Average value per ton	17.50	13.30
Milling costs	1.313	1.117
Mining costs	2.373	2.116

Mr. A. R. Globe, assistant manager notes that operations were under normal conditions in the period of March 25th, in contrast with the four weeks ending Feb. 25, when a break down in power caused a lessening of production. It will be noticed that while production was maintained a rich stope had to be pulled in order to keep the general average. The comparative low value per ton for the period ending in March is a reaction from this pulling of reserve ore. The costs show a welcome declination from the high level obtaining at the beginning of the year. A fall of more than a dollar a ton in a month is noteworthy.

The assistant manager, Mr. A. R. Globe, comments upon the reports as follows: "The mill ran 94 per cent. of the possible running time, treating 14,820 tons, of which 541 tons were treated for the Acme gold mines. The average value of Hollinger ore treated was $13.30 per ton; approximate extraction $96.40; milling costs were $1.117 per ton.

During the period a new ore body, 6 ft. wide, at $12 per ton, was crosscut on the 200 ft. level. Diamond drilling on the 100 ft. level, with lateral holes, located two new ore bodies of medium grade ore, 13 and 31 ft. in width respectively. General development amounted to 766 ft. and diamond drilling 880 ft.

Teck-Hughes.—Development of the Teck-Hughes at Kirkland Lake is proceeding very satisfactorily under the management of Mr. A. H. Smith. An ore shoot 120 ft. long has now been developed on No. 3 vein, with an average width of 3 ft. of $42 ore. This vein is entirely in the porphyry. From the No. 3 shaft a vein only about 6 in. wide is being followed in the conglomerate. It will average $92 to the ton. All development so far is on the 75 ft. level.

Work is proceeding with a small compressor, and is necessarily slow until the hydro-electric power from Charlton is available for the whole district.

Dome.—The official report of operations for the Dome mines for the month of March shows that both tonnage and average value per ton were a little better than in the preceding month. There was milled 14,970 tons. The value of gold produced was $87,657. The mill was operated for 88 per cent. of the possible running time.

A preliminary summary of mining operations at the Dome shows that for the twelve months ending March 31st, 145,210 tons was milled of a value of $1,204,263, giving an average value of $8.29 per ton in gold recovered.

Goldfields, Ltd.—A contract has been let to sink a shaft 200 ft. below the open cut at the Goldfields, Ltd., at Larder Lake. An endeavor will be made to open up new levels and put in sight ore of a more profitable grade than has been milled heretofore.

Tough-Oakes Mine. New Compressor House at Left

Jupiter.—The McKinley-Darragh-Savage Mining Co. started work on the Jupiter on Good Friday, Mr. C. F. Cretney, for many years superintendent of the Savage at Cobalt, taking charge of operations. The water has been lowered in the shaft down to the 200 ft. level already, and the plant is being overhauled. The No. 2, or main shaft, of the Jupiter is down to the 300 ft. level and a winze on the main vein gives an additional 100 ft. It is proposed to continue the winze down another 100 ft., giving a total depth of 500 ft.

The Jupiter shareholders ratified the agreement with the McKinley-Darragh in Montreal on May 8th, and the purchasing company lost no time in getting to work.

Tough-Oakes.—Development of the No. 3 vein at the Tough-Oakes mine is very satisfactory. At 90 ft. the vein which is being followed down shows 12 in. of $500 ore. At 100 ft. a drift will be started on the vein.

The 300 ft. level at the main shaft has now been es-

tablished. There is no change in the formation and the vein continues about the same width and with much the same values.

Work is being delayed by inadequate power. It was hoped that hydro-electric power would be available by May 1st. Good progress has been made, but it is hardly expected that it will be ready by that time. The installation at Charlton has been completed.

Swastika.—Prospectors report some good discoveries in the vicinity of Sesikinika and Kenogami, north and west of Swastika. This part of the country has only been very lightly prospected, and results so far have justified efforts to discover more veins.

COBALT, GOWGANDA AND ELK LAKE

Peterson Lake.—After a lengthy dispute as to the boundary between the Savage mine and the Peterson Lake Mining Company's property, the McKinley-Darragh-Savage Co. staked approximately four acres of property adjoining the Savage, and which they allege is open for staking. The mining recorder at Haileybury accepted the staking, as the area showed it to be open on the maps. The application is made in the name of Mr. T. R. Finucane, manager of the McKinley-Darragh-Savage Mining Co., and is described as follows:

"A point of land formerly under the waters of Cart lake, in the north-west corner of lot 5, concession 4, township of Coleman, commencing at the point where the boundary line between Con. 4 and 5 join the east shore line of Cart lake, thence in a south-westerly direction along the old shore line to No. 2 post, thence in a north-westerly direction along the old shore line to No. 3 post, thence north along the old shore line to No. 4 post, where shore line joins the boundary between concessions 4 and 5; thence east along the said boundary line to point of commencement. The claim was staked on April 10th, in the name of T. R. Finucane, license No. 11290B, by G. E. H. Booth, license No. 5178F. The discovery post is located 166 ft. from No. 1 post."

This area is shown on geological maps of the Department of Mines as belonging to the Gould Consolidated lease of Peterson Lake Mining Co. The action has aroused great interest in the camp, inasmuch as the land staked is right in the centre of the most interesting section of the camp. The area staked is all conglomerate, and although nothing of importance has been discovered upon it, the results being obtained on the Gould and Seneca give it a high potential value. Discovery was made from the 200 ft. level of the Savage, a crosscut being continued into the ground disputed.

There is little doubt that the dispute will be aired in the courts.

Nipissing.—The net earnings of the Nipissing showed a substantial increase, being $261,378, against less than $200,000 during the preceding month.

The discovery of the month was made in a long crosscut from the Meyer vein. It is two in. wide of 1,000 oz. ore. It is now in broken ground and if precedent is to be relied upon will improve as the drift draws away from the faults. This vein, which is supposed to be No. 98, has not been encountered previously underground, though it shows on the surface as cobalt ore with a little silver.

Shaft on No. 3 Vein, Tough-Oakes Mine, Kirkland Lake

A depth of 900 ft. has been attained at No. 64 shaft and crosscutting to the main vein is proceeding.

The high grade mill treated 184 tons and shipped 696 oz. of fine silver. The low grade mill treated 6,802 tons.

The diamond drilling on Peterson Lake has been completed. The diabase-slate contact was found at 300 ft. and the slate-Keewatin contact at 334 ft. The diamond drill has now been set up on Cart lake, with the purpose of picking up the extension of the Seneca-Superior vein.

The hydraulic pump will be moved from Cobalt to Peterson Lake as soon as a very small area on the west side of Nipissing hill has been cleared.

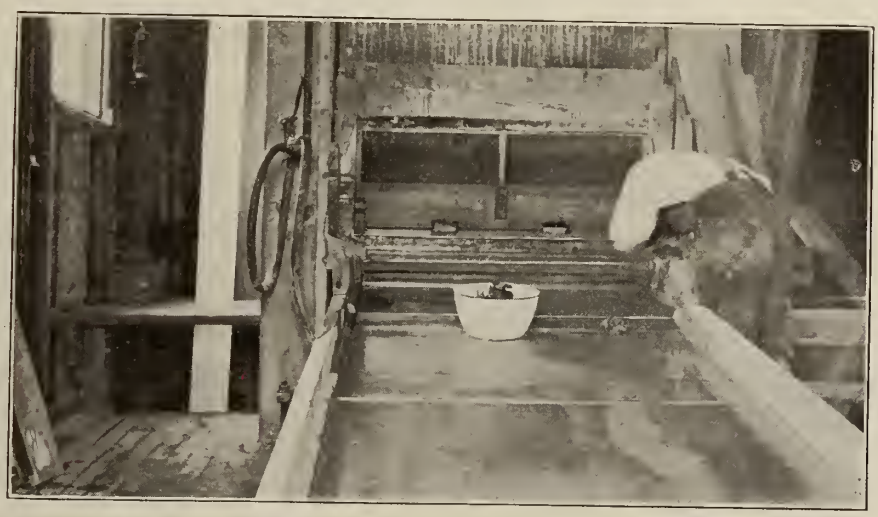
Kerr Lake.—The pumps used for dewatering Kerr lake have been started up again. During the winter a considerable amount of water has flowed back into Kerr Lake from the sorting plant of the Kerr Lake.

This is considered rather fortunate than otherwise, since it is hoped to be able to pump out a good deal of mud lying at the bottom of the lake. This mud must be cleaned out of the bottom of the lake so that the workings can be carried to the surface.

Gould.—Upon the Gold Consolidated lease on Cart Lake the vein which was struck at the 200 ft. level has been picked up again at the 280 ft. level in a cross-cut from the bottom of a winze. The vein here is an inch and a half wide, and in the 20 and 30 ft. of drifting done appears to be much stronger than at the upper level.

Caribou-Cobalt.—Owing to the fact that the Dominion Reduction cannot take as much ore as they can produce the Caribou-Cobalt is now sending 50 tons of ore a day to the Northern Customs mill. The Northern Customs mill is now treating La Rose and Caribou-Cobalt ore and will take up their contract with the Chambers-Ferland on May 1st.

The Green Meehan mine at North Cobalt is now in the hands of the sheriff. The machinery and plant has been seized and will be sold for debt. The Green Meehan was one of the famous mines of the district in 1906 and 1907, but the high grade was very shallow. It has been leased a number of times, but never met with any success.



Amalgamating Plates, Tough-Oakes Stamp Mill, Kirkland Lake, Ont.

BRITISH COLUMBIA

Mining is being resumed in those metal mining districts in which winter conditions necessitated a temporary suspension of work while the snow was deep. In the placer gold camps preparations are being made for the ensuing season's work. Coal mining is at present least satisfactory of all classes of mining in the Province, for although labor difficulties no longer seriously interfere with production of coal, demands are comparatively small. This is due to a mild and short winter, so far as affects interior mines, and to foreign coals and fuel oil having secured a strong hold of markets that prior to the Vancouver Island coal strike were supplied chiefly from Coast coal mines. It is hoped, though, that gradually a return will be made to former activities. Meanwhile there are more coal miners obtainable for Island mines than there is regular work for, and the strikers who still stay with the United Mine Workers of America are slowly, though reluctantly, realizing that they will not succeed in compelling the companies owning the collieries to come to their terms. Their places in the mines have already been filled, and more coal is being produced than can at present be sold.

East Kootenay.

Society Girl.—A few men have been sent up to the Society Girl mine to resume work after the winter shut down. The Society Girl group, as described in the official annual report, consists of seven Crown-granted mineral claims, situated two miles to the south-east of the town of Moyie, just over the summit of the first range of hills lying east of Moyie lake, and an altitude of from 5,000 to 5,200 ft. at the upper workings, or 2,000 ft. above the lake. It has for years been owned by the Society Girl Mining Co., composed of working miners and prospectors, with Mr. Charles Farrell as the chief moving spirit. In some years the miners have been paid for their work chiefly in shares of the company, so that the enterprise has been much in the nature of a miners' co-operative partnership. Though, without money to pay for extensive development, much work has been done by the shareholders. The workings are chiefly open cuts and prospect shafts, which have exposed ore in a number of places. One adit was driven 250 ft. and ore stoped to the surface 80 ft. above, about 700 tons having been taken out. Another adit, about 40 ft. lower, was driven 800 to 900 ft. The country is much broken near the surface, which has made the vein irregular in the upper workings, but it is thought that the strata will be undisturbed at depth, as was the case in the St. Eugene mine; situated near to Moyie. The ore is galena, containing on an average .5 oz. silver to one per cent. of lead; it occurs in a quartz gangue and is associated with some zinc. Near the surface it is chiefly lead carbonate with some galena.

Similkameen.

Platinum Placers.—It is reported at Princeton that the placer leases of Coulthard, Kirkpatrick, McGowan, and Snowden Bros. have been acquired by American capitalists. The ground covered by these leases is known as the Roany placers. It is situated along Tulameen river, between Granite creek and Princeton, the

most westerly part being a short distance below the confluence of Granite creek with Tulameen river. From its junction with the Similkameen river at Princeton, the Tulameen for fully 25 miles, up to the mouth of Champion creek, has been for many years worked by placer miners for gold and platinum. Mr. Charles Camsell of the Geological Survey of Canada, in his report on the "Geology and Mineral Deposits of Tulameen District" (Memoir No. 26, 1913), states that there is some evidence that the Tulameen placer deposits were worked to a limited extent many years before 1885. In that year they came into considerable prominence through the discovery of coarse gold on Granite creek. For the few years following, the district produced remarkably well for such a small area, and about 1891 it came to be recognized as the most productive platinum region on the North American continent. Since then the production has steadily declined year by year, until it has become so small that placer mining is now done in only a very small way by a few miners here and there along the river and its tributary creeks. The streams that have yielded an appreciable amount of gold or platinum or both are: Tulameen river, Granite creek and its tributary Newton creek, Collins gulch and Cedar, Slate, Bear, Hine, Eagle, Champion and Boulder creeks. The river has not been proved to be everywhere productive in gold or platinum. The reason for this is not apparent, but it is probably because bed rock is not easily reached in some parts of it. Mining has been carried on in three separate sections, namely, near the mouth of the river at Princeton; about two miles below Granite creek, including the Roany placers above mentioned; and between Slate creek and the mouth of Champion creek, along a length of five or six miles. Other facts in connection with the mineral resources of the Tulameen are noteworthy, namely, that (1) the platinum recovered from the gravels of the district has been variously estimated at from 10,000 to 20,000 oz.; that (2) Prof. J. F. Kemp, Columbia University, in 1900 spent three months in the district investigating the original source of the platinum of the placers (see U. S. Geol. Survey Bull. 193); and (3) that after the discovery by the Geological Survey of Canada of diamonds in chromite segregations in the peridotite of Mt. Olivine, Mr. Camsell found many small diamonds in gravels of Tulameen river.

Lillooet.

Attention is again being called to the mining possibilities of Cayoosh creek, in both lode and placer mining. It is well known that years ago Chinese took much placer gold out of this creek. One local merchant repeatedly stated that he had bought more than $200,000 worth of gold from them, and that this amount represented only the exchange for the supplies they had purchased from him. Although there is now difficulty in finding out what parts of the bars in the creek have not been worked, higher water bringing down fresh gravel each season, and so effacing indications of where work has been done in the past, it is known that there is gold-bearing ground on the creek above high-water mark, some within ten miles of Lillooet, adjacent to old claims from which much gold was taken—ground that has not been worked to any extent. Such places are above Gold basin—where there are possibly half a dozen claims—both sides of the stream above the mouth of Cottonwood creek, and still farther up Cayoosh creek. The gold up there is coarse and easily saved, but as a rule the wash is heavy, so that placer miners are not likely to get much gold without working the ground thoroughly.

Penn-Canadian Silver Mine, Cobalt, Ont.

Skeena Mining Division.

The Granby Consolidated Mining, Smelting & Power Co., which in March commenced smelting operations at its new reduction works at Anyox, Observatory inlet, has not yet blown in a second blast furnace, owing to difficulty in obtaining sufficient competent machine miners to allow of ore being got out of the Hidden Creek mines in large enough quantity to keep two furnaces supplied. This is a contingency that had not been taken into account by those who had expected a comparatively large production of copper at the new smeltery almost immediately after making a commencement to smelt the ore. The company has done what it could to attract men in sufficient numbers, by erecting accommodation buildings of modern style and providing them with con-

veniences and furnishings, ensuring comfort to those who occupy them. Now that winter has been passed through, there is a long season of good weather to be expected. It is hoped that when it becomes known in other mining camps that conditions underground are satisfactory and accommodations for miners even better than in some of the old established camps, while communication with "the outside" by steamer is frequent, and supplies of all kinds easily and quickly obtained, that many experienced and capable machine men will go to Hidden Creek, where employment is now regular and will be lasting.

General Notes.

Work has been resumed at the Rambler-Cariboo silver-lead mine and concentrating mill, the melting snow now supplying sufficient water to run the Pelton wheels that operate compressor and mill machinery.

The Nelson "Daily News" has published a news item stating that during March 2,020 tons of copper ore was shipped from the British Columbia Copper Co.'s Queen Victoria mine, near Nelson, to the company's smelting works at Greenwood.

On the Coast it is reported that Tonopah-Belmont Co., of Philadelphia, Pa., has acquired an option of the gold mining property of the Surf Inlet Gold Mines, Ltd., situated on Princess Royal island, and that conditions of the provisional sale require that a stamp-mill and cyanide plant, to have a treatment capacity of 400 to 500 tons of ore a day, are to be erected and equipped by the first mentioned company.

An interesting reminder of the early days of Rossland camp is contained in the following excerpt from "Spokesman Review," of Spokane, Washington, which under the heading of "Twenty Years Ago To-day," on April 5, reprinted the following news item: "The first steamer-load of ore from the Le Roi mine was taken down the Columbia river from the Trail landing to Northport on Monday. There was 987 tons at the landing, the result of the winter's work; the steamer took away 64 tons."

During the period from January 1 to April 7 of this year there has been treated at the Granby Con. Co.'s smelting works at Grand Forks, Boundary district, 323,141 tons of ore, of which 315,909 tons was from the company's mines at Phoenix and 7,232 tons was custom ore. The quantity of blister copper shipped to the refinery during the same period was 5,578,550 lb.

A report has been published in Vancouver that the Horsefly hydraulic gold mine will be operated during the coming summer. It is also stated that several other placer gold mines in the Horsefly section of Quesnel mining division, Cariboo district, will be worked as well.

GRANBY.

Boston, April 27.

A call has been sent Granby Consolidated stockholders for a special meeting to be held May 13, "for the purpose of authorizing directors to borrow and secure repayment of moneys for purposes of the company up to $3,000,000."

President Nichols of Granby Consolidated, in supplementing recent report to stockholders, says that on March 16 the first furnace at Hidden Creek smelter went into commission, and the second started April 11.

"The new plant starts up in a very gratifying manner, and while it is yet too early to give exact smelting figures which will be reached, enough has been learned to warrant assumption that we shall deliver refined copper in New York at less than ten cents a pound.

"Under our charter directors are not permitted to borrow in excess of $1,000,000 without sanction of stockholders. As our output of copper will be more than doubled, a large portion of which will at all times be in transit, additional working capital will be required and directors should be in position to take advantage of temporary loans whenever it is more desirable than to sell bonds which can be paid off at 110."—Boston News Bureau.

In our last issue we published a despatch from Vancouver stating that the delay in starting the new smelting plant of the Granby Cons. M. S. & P. Co. was caused by a break in the dam. We are advised by our B. C. correspondent, Mr. E. Jacobs, that no such accident occurred. Mr. Jacobs also calls attention to the fact that the Granby Co.'s engineers estimate that at the Hidden Creek property there has been developed about 9,000,000 tons of ore, carrying 2.2 per cent. copper, besides a large quantity of lower grade ore.

DANE MINING CO.

According to the secretary of the company, the Dane Mining Co., Ltd., owns 240 acres of patented lands in the townships of Teck and Lebel, all in one block, good buildings and an up-to-date plant. About 72,000 tons of low grade copper ore has been blocked out. The company shipped 62 tons of 8.4 per cent. to the smelters at Chrome, N.J., in January of this year. The works have been closed down since December 1st, 1913, partly on account of damages sustained by fire and the lack of sufficient power. The company's properties are very promising and will, no doubt, be further developed in the near future. The location of the Dane mines is two and a half miles directly south of the Tough-Oakes gold mines in the Kirkland Lake district. Mr. Shirley Ogilvie is president and Mr. Alex. McKinnon is secretary-treasurer of the company.

THE IRON INDUSTRY.

According to reports from Ottawa the Government proposes to institute an enquiry by the Mines Department into the iron resources of the country and improved methods of treating iron ore.

Mr. Frederic Nicholls, Consul for Portugal, Toronto, has received the following letter from the Commercial Association of Lisbon, Portugal: "Being desirous of enlarging our commercial business, especially the foreign one, the directors of the Association have approved of the installation of a room for catalogues of the most important commercial houses in the world, in order to have our business men acquainted with prices of all articles in the world's market, and for the above reason we ask you to be kind enough to invite by the most practical means the commercial houses of your district that export their products to present their catalogues to the Association."

PAINKILLER LAKE.

Mr. H. C. Crow, of the Cartwright Gold Fields, Ltd., states that it is the intention of the company to sink a shaft on one of the veins on the property at Painkiller lake. The report of Mr. E. W. Phillips states that deposit contains gold tellurides.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

April 23, 1914.

New York Curb.

	Bid.	Ask.
American Marconi	3.75	4.00
Alaska Gold	26.12	26.38
British Copper	1.50	1.75
Braden Copper	8.00	8.12
California Oil	285.00	290.00
Chino Copper	39.38	39.50
Giroux Copper	.25	1.00
Green Can.	30.00	31.00
Miami Copper	22.37	22.75
Nevada Copper	14.18	14.75
Ohio Oil	163.00	166.00
Ray Cons. Copper	20.37	20.62
Standard Oil of N. Y.	207.00	209.00
Standard Oil of N. J.	395.00	399.00
Standard Oil, (old)	1340.00	.....
Standard Oil (subs)	940.00	.....
Tonopah Mining	6.12	6.38
Tonopah Belmont	7.00	8.00
Tonopah Merger	.55	.56
Inspiration Copper	16.50	17.50
Goldfield Cons.	1.43	1.50
Yukon Gold	2.50	2.62

Porcupine Stocks.

	Bid.	Ask.
Apex.	.02½	.03
Dome Extension	.08¼	.08½
Dome Lake	.41	.41½
Dome Mines	8.00	8.50
Foley-O'Brien.	.19	.21
Hollinger.	15.90	16.00
Jupiter.	.10½	.11
McIntyre.	.28	.31
Moneta.	.02	.04
North Dome	...	.05
Northern Exploration	2.25	2.75
Pearl Lake	.07	.07½
Plenaurum.	...	.50
Porcupine Gold	.09¾	.10
Imperial.	.01½	.02
Porcupine Reserve	...	.07
Preston East Dome	.02	.02½
Rea.	.15	.20
Standard.	...	.01
Swastika.	.02	.02¼
United.	...	.01
West Dome	.10	.12
Porcupine Crown	.75	.90
Teck Hughes	.12	.14

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.03	.03¼
Beaver.	.28	.29
Buffalo.	1.00	1.15
Canadian.	.06	.08
Chambers Ferland	.20½	.21
City of Cobalt	.47	.50
Cobalt Lake	.45	.50
Coniagas.	7.00	7.50
Crown Reserve	1.23	1.26
Foster.	.06	.07
Gifford.	.02½	.03
Gould.	.02¾	.03
Great Northern	.09¾	.10
Hargraves.	.02½	.03
Hudson Bay	74.00	78.00
Kerr Lake	4.00	4.15
La Rose	1.40	1.43
McKinley.	.61	.63
Nipissing.	6.30	6.40
Peterson Lake	.37	.38
Right of Way	.03	.04
Rochester.	.02	.03
Leaf.	.01¾	.02
Cochrane.	.35	.50
Timiskaming.	.14½	.15
Trethewey.	.20	.25
Wettlaufer.	.06	.07
Seneca Superior	2.75	3.00

TORONTO MARKETS.

April 24.—(Quotations from Canada Metal Co., Toronto).
Spelter, 5¼ cents per lb.
Lead, 5 cents per lb.
Tin, 39 cents per lb.
Antimony, 8½ cents per lb.
Copper, casting, 15 cents per lb.
Electrolytic, 15 cents per lb.
Ingot brass, 10 to 15 cents per lb.

April 24.—Coal—(Quotations from Elias Rogers Co., Toronto).
Anthracite, $8.25 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

April 22.—Connellsville coke, (f.o.b. ovens).
Furnace coke, prompt, $1.85 to $1.95 per ton.
Foundry coke, prompt, $2.35 to $2.50 per ton.

April 22.—Tin, straits, 35.60 cents.
Copper, Prime Lake, 14.50 to 14.75 cents.
Electrolytic copper, 14.20 to 14.30 cents.
Copper wire, 15.50 cents.
Lead, 3.80 cents.
Spelter, 5.15 to 5.25 cents.
Sheet zinc, (f.o.b. smelter), 7.00 cents.
Antimony, Cookson's, 7.15 to 7.25 cents.
Aluminum, 18.00 to 18.25 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $43.00 to $44.00 per ounce.
Platinum, hard, 10%, $46.00 to $47.50 per ounce.
Platinum, hard, 20%, $49.00 to $51.50 per ounce.
Bismuth, $1.95 to $2.15 per pound.
Quicksilver, $38.00 per 75-pound flask.

SILVER PRICES.

	New York cents.	London pence.
April 9.	58½	26 15/16
" 10.	58⅜	....
" 11.	58¼	26 13/16
" 13.	58¼	....
" 14.	58¼	26 13/16
" 15.	58¼	26 13/16
" 16.	58¼	26 13/16
" 18.	58¼	26 13/16
" 17.	58¼	26 13/16
" 20.	58⅜	26⅞
" 21.	58⅜	26⅞
" 22.	58½	26 15/16
" 23.	58½	26 15/16
" 24.	58½	26 15/16

YOUR Filtration Clarification Precipitation COSTS

CAN BE REDUCED BY THE

MERRILL PROCESSES

Zinc Dust Precipitation
Automatic Sluicing Slime Filters
Direct Press Leaching Process (for Gold and Copper Ores)
Automatic Sluicing Clarifying Filters
Concentrating Cones

IF YOU ARE INTERESTED SEND FOR OUR CATALOGUE

MERRILL METALLURGICAL COMPANY

Cable Address : LURCO.

SAN FRANCISCO, CAL., U.S.A.

CODES { Bedford McNeill / Moreing & Neal

TEMISKAMING AND NORTHERN ONTARIO RAILWAY

(ONTARIO GOVERNMENT RAILWAY)

SIR JAMES P. WHITNEY, Premier

Toronto, Montreal through Sleeping and Dining Cars to Timagami, Cobalt, Englehart, Elk Lake, Porcupine, Cochrane, traversing the far-famed Timagami Lakes---the Sportsmen's Paradise.

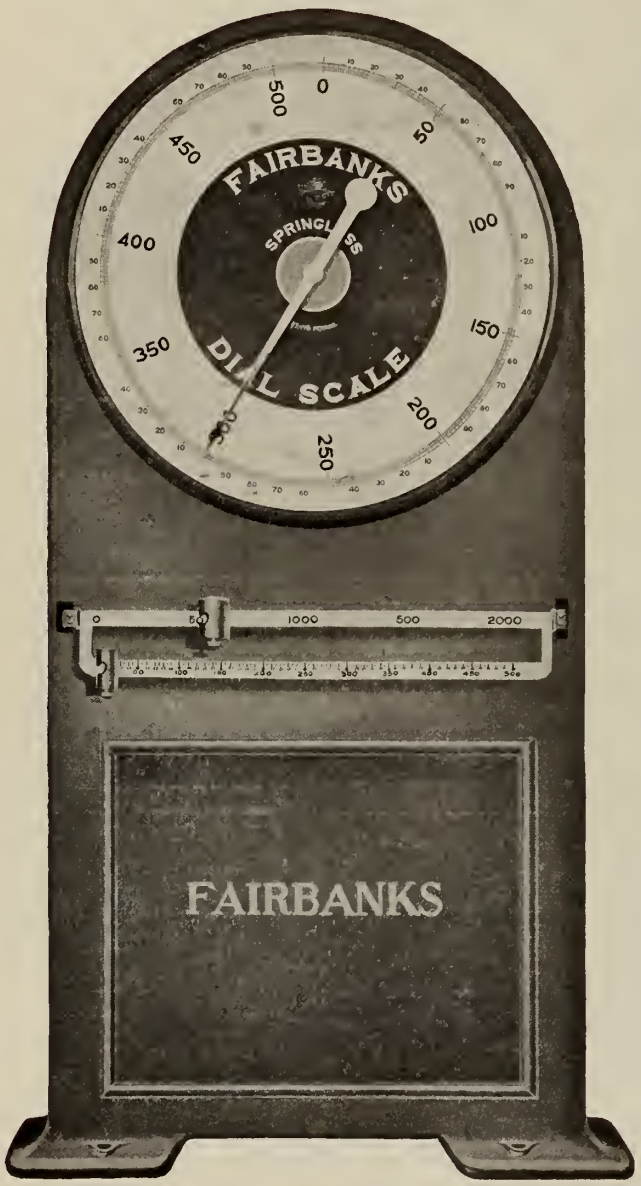
Through the rich and well-known Cobalt silver and Porcupine gold districts. Through the great clay belt---20,000,000 acres of rich agricultural lands await the settler.

For full information, pamphlets, time tables, etc., apply:—

GEO. W. LEE, Land Commr., North Bay, Ont.

A. J. PARR, G. F. & P. A., North Bay, Ont.

A. J. McGEE Sec.-Treas. Toronto, Ont.



Fairbanks Springless Dial Scales

The illustration shows Dial Attachment for Dormant Warehouse Scales.

Dial 30" in Diameter.
Graduated 1000 lbs. x 1 lb.
Auxiliary Beam, capacity 2000 lbs.
Tare Bar, 500 lbs. x 1 lb.

¶ With a Fairbanks Dial Scale You Can Decrease your Weighing Time to a Minimum.

¶ These dials are made in Canada and are specially designed for this climate. ¶ They are springless and are not affected by temperature changes. ¶ They can be attached to any Dormant Warehouse Scale and, in this day of progressive methods, should be used in every plant.

Write at once for complete information

The Canadian Fairbanks-Morse Co. Limited

Montreal St. John Quebec Ottawa Toronto Hamilton Fort William
Winnipeg Regina Saskatoon Calgary Edmonton Vancouver Victoria

Canada's Departmental House for Mechanical Goods

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & Deyell
Heys, Thos. & Son
Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd
Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place - New York City
General Manager
Consolidated Arizona Smelting Co.,
Humboldt, Ariz.

DEPENCIER, H. P.
Consulting Mining Engineer
Room 613, Dominion Express Bldg.,
MONTREAL.
Phone Main 4984 P. O. Box 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
Belleville, Ontario.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

Phones { Office Main 6935 / Res Lachine 218

JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

What is your specialty ?
What is your address ?
Our readers want to know.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

WILLMOTT, A. B., M. A. Sc.
Mining Engineer,
404 Lumsden Building, Toronto Can.
Cable Abmott. Phone Main 6407

LAWYERS

Telephone Main 3813
Cable Address: "Chadwick" Toronto Western Union Code
E. M. Chadwick, K.C
David Fasken, K.C.
M. K. Cowan, K.C.
Harper Armstrong
Alexander Fasken
Hugh E. Rose, K.C.
Geo. H. Sedgewick.
James Aitchison
Beatty, Blackstock, Fasken Cowan & Chadwick
Barristers, Solicitors, Notaries
Offices: Bank of Toronto, Cor. Wellington & Church Sts.
58 Wellington St. East Toronto

G. G. S. Lindsey, K.C.
Telephone Main 6070
Cable Address: "Lindsey," Toronto Codes, Broomhall, McNeil's 1908
Commissioner for taking affidavits in British Columbia.
counsel with
Gregory & Gooderham, Barristers and Solicitors,
Canada Life Building, Toronto

Phone Main 2311 Cable Address "Segsworth" Toronto
R. F. SEGSWORTH
Barrister, Solicitor, Notary, Etc.
JARVIS BUILDING
103 Bay Street - TORONTO

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

WANTED—DRAUGHTSMAN familiar with Mill Work. State Experience and Salary Wanted.
Moose Mountain, Limited, Sellwood, Ont.

Mine superintendent, foreman, surveyor and assayer, with fifteen years experience, open for engagement.
Address Box 5, Can. Mining Journal, Toronto.

TO INVESTORS
I want $1,500 to fit out a prospecting expedition to carry on exploration work in the new gold field. Parties putting up the money will be entitled to a claim.
Box "A". Canadian Mining Journal

The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

Guide Books to excursions of the International Geological Congress.

1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1173. Memoir 20. Gold fields of Nova Scotia, by W. Malcolm. Map not published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1279. Memoir 25. Report on the clay and shale deposits of the Western Provinces, by Heinrich Ries and Joseph Keele.

1225. Memoir 30. The basins of Nelson and Churchill rivers, by William McInnes. Map not published.

BRITISH COLUMBIA

1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1162. Map 26A. Bathurst and vicinity, Gloucester County, New Brunswick. Topography.

1163. Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.

1300. Map 100A. Bell River, Quebec. Geology.

1301. Map 101A. St. Hilaire and Rougemont Mountains, Rouville and St. Hyacinthe Counties, Quebec. Geology.

ONTARIO

1199. Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.

1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.

1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.

1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.

1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.

1304. Map 106A. Groundhog coal field, British Columbia. Geology.

1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

1298. Map 99A. Southern portion of Cranbrook map-area, East and West Kootenay, British Columbia. Geology.

YUKON and NORTH WEST TERRITORIES

1332. Map 113A. Canadian routes to White River district, Yukon, and to Chisana district, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BOILERS

"INGLIS" STANDARD RETURN TUBULAR BOILER

We make Boilers of all kinds for any service.

For Fifty-two (52) years our boilers have been recognized as the Canadian Standard because they combine all the essentials requisite to produce the best boiler.

Is is a pleasure for us to show prospective buyers our different types of boilers in operation.

WRITE US FOR PRICES AND SPECIFICATIONS

The John Inglis Co.,
LIMITED

Engineers and Boilermakers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL. 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office: 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of

Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

¶ *Complete Bound Copies for 1913 Canadian Mining Journal, with Index, are now ready. Price $4.00 per volume. Canadian Mining Journal, 44-46 Lombard Street, Toronto.*

Sprague Steel Armoured Hose

FOR COMPRESSED AIR OR STEAM

Sprague Flexible Steel Armoured Hose can be used advantageously wherever air or steam hose is now employed. Excavating and tunnelling contractors, mining companies and quarrymen will find it far more efficient and economical in operating drills and other machinery than any hose heretofore used. Machinists using either air-driven or steam tools will find it much more durable and reliable than ordinary unarmoured or wire-wound hose.

Canadian General Electric Co., Limited
HEAD OFFICE, KING and SIMCOE STS.,
TORONTO

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.
The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFERIOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co...Inside front cover
American Diamond Rock Drill Co. 16
Astley, J. W. 23

B

Bartlett, C. O., & Snow Co. 17
Bath, Henry & Son 28
Beatty, Blackstock, Fasken, Cowan & Chadwick 24
Beatty, M. & Sons, Ltd. 11
Belleville Assay Office 25
Bennett, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons 16
Blackwell, Geo. G., Sons & Co. ... 28
British Columbia, Province of ... 18
Brown & Butters 23
Burchell, Geo. B. 23

C

Canadian Allis-Chalmers, Limited.. 29
Campbell & Deyell 25
Canadian Cleveland Drill Co 9
Canadian Copper Co. 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22
Canadian Laboratories, Ltd. 25
Canadian Northern Steamships ... 6
Canadian Ingersoll-Rand Co., Ltd... 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith 23
Cohen, S. W. 23
Colvocoresses, G. M. 23
Consolidated Mining & Smelting Co 28
Coniagas Reduction Co., Ltd. 28
Curtis's & Harvey .....
.....Outside back cover

D

Dept. of Mines, Canada 26
Deloro Mining & Reduction Co... 28
DePencier, H. P. 23
Diamond Drill Contracting Co..... 16
Dominion Coal Co., Ltd. 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co. 16
Donald, Dr. J. T. 25
Drury, H. A. Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Electric Steel & Metals Co., Ltd. .. 8
Evans, J. W. 23

F

Ferrier, W. F. 23
Fleck, Alex. 6
Flory, S., Mfg. Co. 12
Forbes, D. L. H. 23
Fowler, S. S. 23
Fraser & Chalmers of Can., Ltd.... 4
Federal Engineering Co., Ltd. 31

G

Graham, S. N. 23
Gray, John 25
Greening, B., Wire Co., Ltd. 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John 24
Hardman, J. E. 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd. 25
Heys, Thos. & Son 25
Hille, F. 24
Holman Drill Co. 20

I

Inglis, John & Co., Ltd. 27
Imperial Bank of Canada 2
Industrial & Technical Press, Ltd.. 13
International Nickel Co. 8

J

James Ore Concentrator Co. .....
.....Outside back cover
Jeffrey Mfg. Co. 19
Johnson, W. S. 24
Jones & Glassco 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co. 25
Legg Bros. Engraving Co. 35
Loring, F. C. 24
Lymans, Limited 9
Lands of the Algoma Central and Hudson Bay Ry. 36
Lindsey, G. G. S. 24

M

Merrill Metallurgical Co. 21
Herbert Morris Crane & Hoist Co., Ltd. 16
Morton, B. K. & Co. 18
McEvoy, James 24
Mussens, Limited .....
.....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co. 10
Nova Scotia, Province of 15
Northern Canada Supply Co., Ltd. 6
Northern Electric Co., Ltd. 5

O

Orford Copper Co. 8
Ontario, Province of 30

P

Peacock Bros. 7
Pickings, H. B. 24
Pyke, James W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd. 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Segsworth, W. E. 24
Smart-Turner Machine Co. 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd. .....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Standard Underground Cable Co... 15
Sullivan Machinery Co. 2
Summerhayes, Maurice W. 24
Swedish Steel & Importing Co., Ltd. 12

T

Geo. Taylor Hardware Co., Ltd.... 4
Timiskaming & Northern Ont. Ry.. 21
Toronto University 2
Tyrrell, J. B. 24

W

Willmott, A. B. 24
Walker Bros. 7
Waterous Engine Works Co., Ltd. 9

TRADE MARK LANCO BALATA BELTING

Lanco Balata Belting

Use this Belting on your wet drives and for elevating wet material.
This Belt is made as well as it is possible to make a Balata Belt.

If required endless we can make them up at our own warehouse.

FEDERAL ENGINEERING CO., Limited
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

THE ROESSLER & HASSLACHER CHEMICAL COMPANY CHEMISTS NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.
Geo. Taylor Hardware Co,Ltd

Bags—
Smart-Woods, Ltd.

Ball Mills—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineering Co., Ltd.
G. Taylor Hardware Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd
Curtis & Harvey (Canada), Limited.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Blowers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Boilers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers. Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
The John Inglis Co., Ltd.

Buckets—
Rock & Power Mach'y, Ltd.
Peacock Bros.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd

Cable — Aerial and Underground—
G. Taylor Hardware Co., Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.
G. Taylor Hardware Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Cement Machinery—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Chain Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell
Thos. Heys & Son
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Handling Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Compressors—Air—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd
Laurie & Lamb
Canadian Westinghouse
Can. Ingersoll-Rand Co. Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Condensers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Bros.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Waterous Engine Works

Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith
B. Greening Wire Co., Ltd.
G. Taylor Hardware Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Lymans, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roessler & Hasslacher
Thos. & Wm. Smith
Peacock Bros.

Derricks—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Drills—Core—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Can. Ingersoll-Rand Co., Ltd

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Ltd.
Orenstein-Arthur Koppel Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Elevators—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Peacock Bros.

Engineering Instruments—
C. L. Berger & Sons
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Mussens, Ltd.
Alex. Fleck
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
M. Beatty & Sons
Canadian Westinghouse
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Engines—Oil—
Rock & Power Mach'y, Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.

Engines—Steam—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons
Laurie & Lamb
Mussens, Ltd.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Filters—
Krupp, Fried, A. G., Germany

Friction Hoists—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.

Forgings—
M. Beatty & Sons
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Bros.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :					Halifax
QUEBEC :					Montreal
ONTARIO :	Toronto,	Cobalt,	South Porcupine,	Port Arthur,	Kingston
MANITOBA :					Winnipeg
ALBERTA :					Edmonton
BRITISH COLUMBIA :	Vancouver,	Victoria,	Nelson,		Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krup, Fried. A. G., Germany
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey, (Canada), Limited
Canadian Westinghouse
Canadian Explosives
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Gears—
Canadian Westinghouse
Krupp, Fried. A G., Germany
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse
Northern Electric Co., Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Heaters—Feed Water—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Laurie & Lamb
Canadian Westinghouse
Peacock Bros.
Fraser & Chalmers, Ltd.
G. Taylor Hardware Co., Ltd.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air Electric and Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
S. Flory Mfg. Co.
Jones & Glassco
Waterous Engine Works
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Cleveland Drill Co.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Jacks—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives
Peacock Bros.
Ackroyd & Best
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works
Northern Canada Supply Co.
Jones & Glassco

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.
Canadian Westinghouse
Siemens Co. of Canada, Ltd.

Locomotives—Steam—
Mussens, Ltd.
Canadian Westinghouse

Metal Merchants—
Henry Bath & Son
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Northern Electric Co., Ltd.
Can. Fairbanks-Morse Co.
G. Taylor Hardware Co., Ltd.
Canadian Westinghouse
Peacock Bros.
Siemens Co. of Canada, Ltd.

Ore Sacks—
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Ore Testing Works—
Ledoux & Co.
Can. Laboratories
Milton Hersey Co., Ltd.
Campbell & Deyell

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada
Krupp, Fried, A. G., Germany
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Thos. & Wm. Smith
Peacock Bros.

Pipes—
Consolidated M. & S. Co.
Peacock Bros.
G. Taylor Hardware Co., Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Canadian Westinghouse
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
G. Taylor Hardware Co., Ltd.
Jones & Glassco

Producer—Gas—
Krupp, Fried, A. G., Germany
Mussens, Ltd.

Prospecting Mills and Machinery—
Rock & Power Mach'y, Ltd.
Standard Diamond Drill Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
G. Taylor Hardware Co., Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Laurie & Lamb
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Rock & Power Mach'y, Ltd.
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Jeffrey Mfg. Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumatic—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Can. Ingersoll Rand Co., Ltd.

Pumps—Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co. Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
G. Taylor Hardware Co., Ltd.
The John Inglis Co., Ltd.

Pumps—Turbine—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Rock & Power Mach'y, Ltd.
Can. Cleveland Drill Co.
Krupp, Fried. A. G., Germany
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany

Rolls—Crushing—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Can. Allis-Chalmers, Ltd.

Roofing—
Paterson Mfg. Co.
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.
Geo. Taylor Hardware Co,Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.
G. Taylor Hardware Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany
Thos. Heys & Son

Screens—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
R. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Separators—
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
M. Beatty & Sons

Slime Tables—
Deister Concentrator Co.
James Ore Concentrator
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Smelting Machinery—
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.

Stamp Mills—
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drills—
Rock & Power Mach'y, Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A G., Germany
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd
G. Taylor Hardware Co., Ltd.

Steel—Tool—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley
C. L. Berger

Switchboards—
Canadian Westinghouse
Can. Allis-Chalmers, Ltd.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Tanks—Cyanide, Etc.—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.

Transformers—
Canadian Westinghouse
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Peacock Bros.
Siemens Co. of Canada, Ltd.

Transits—
C. L. Berger & Sons
W. F. Stanley
Peacock Bros.

Tractors—Oil—
Can. Fairbanks-Morse Co., Ltd.

Tube Mills—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.

Turbines—
Rock & Power Mach'y, Ltd.
Canadian Westinghouse
Peacock Bros.
Laurie & Lamb
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd

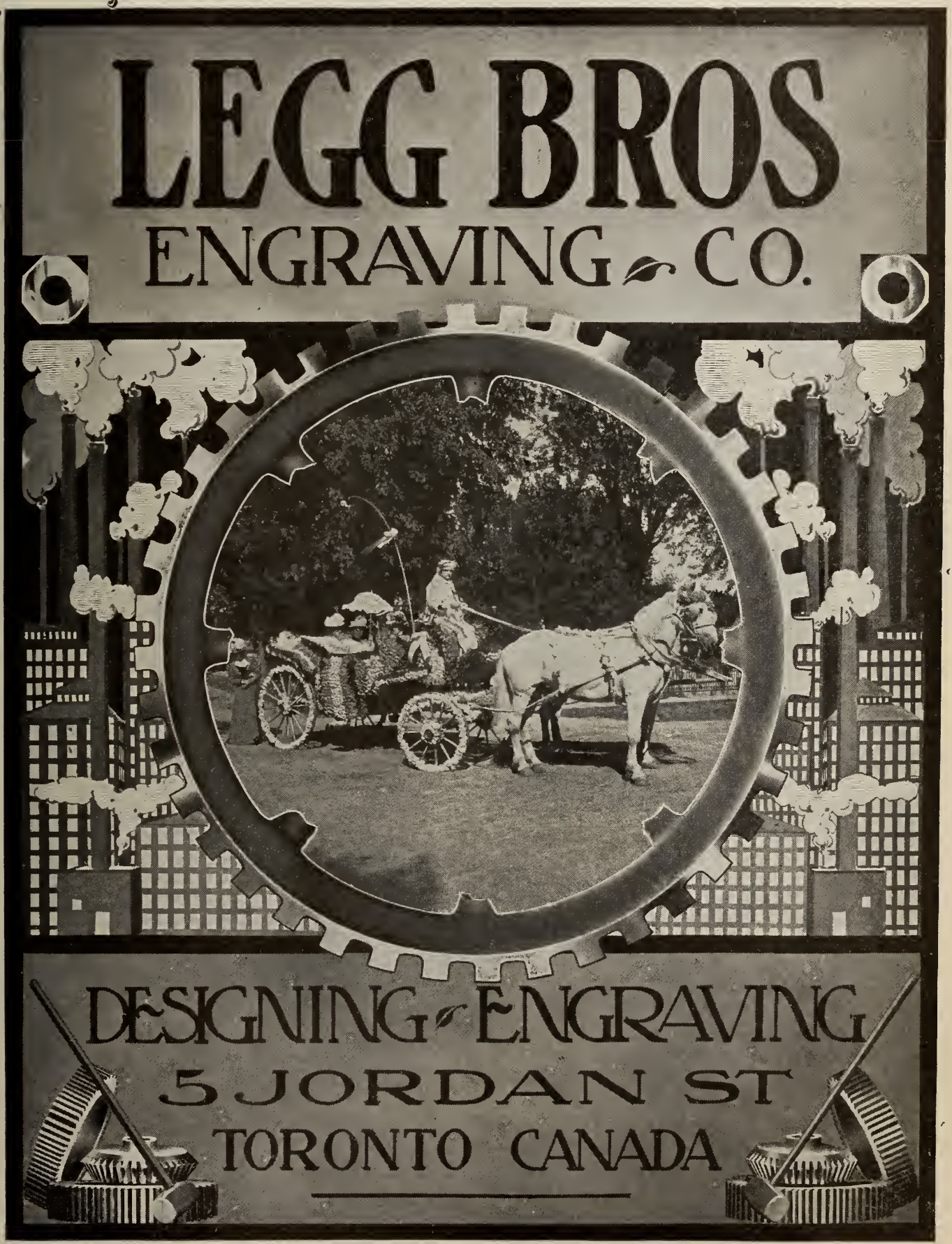
Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Winding Engines—
Rock & Power Mach'y, Ltd.
Waterous Engine Works
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

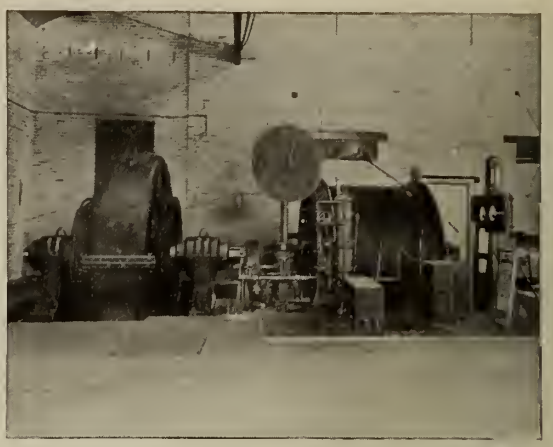
Wire Cloth—
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.


LEGG BROS
ENGRAVING CO.
DESIGNING ENGRAVING
5 JORDAN ST
TORONTO CANADA

Westinghouse Motors and Control, designed especially for electric mine hoist installations, have embodied in their design features that ensure the following:



Westinghouse Motor Driving Large Mine Hoist

Maximum Output Under All Conditions. Liberal design of motors makes it possible to hoist increased loads for a long period to make up for time lost in delivering coal or ore, to the foot of the shaft.

Reliability. Reliability means continuity of service, assuring against loss due to reduced output caused by motor or control trouble.

Ruggedness. The first two points are dependent upon ruggedness of mechanical and electrical construction.

Efficiency. Power consumption per ton output is an important factor. Westinghouse high efficiency means low operating costs.

Safety. All Westinghouse hoisting installations are designed with control arranged to prevent accidents due to overwind, failure of power and errors in judgment of the operator.

Our specialists in mining equipment will be glad to assist you in selecting the proper equipment for your mines. Their services are at your disposal if you will write to the nearest office listed here.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Sq.	Ahern & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

— FOR REGULATIONS, MAPS, ETC., APPLY TO —

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M. A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— *Published by* —

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

— *which also publishes* —

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

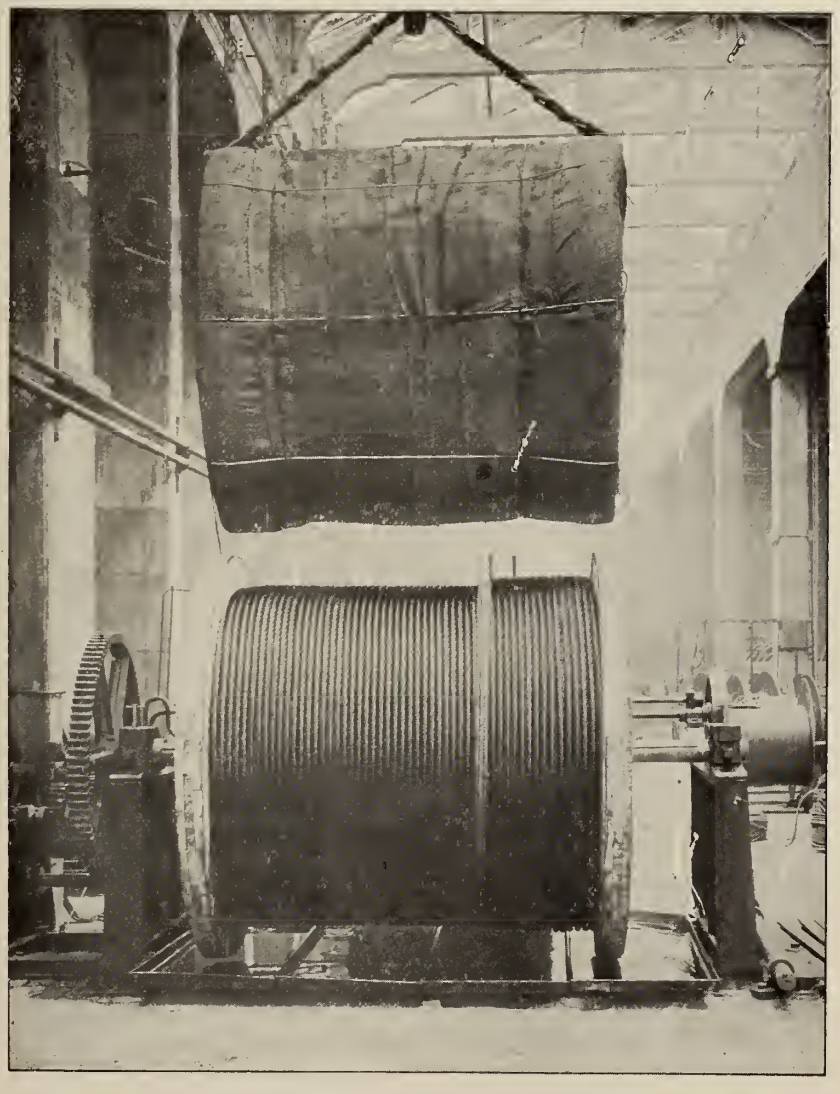
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

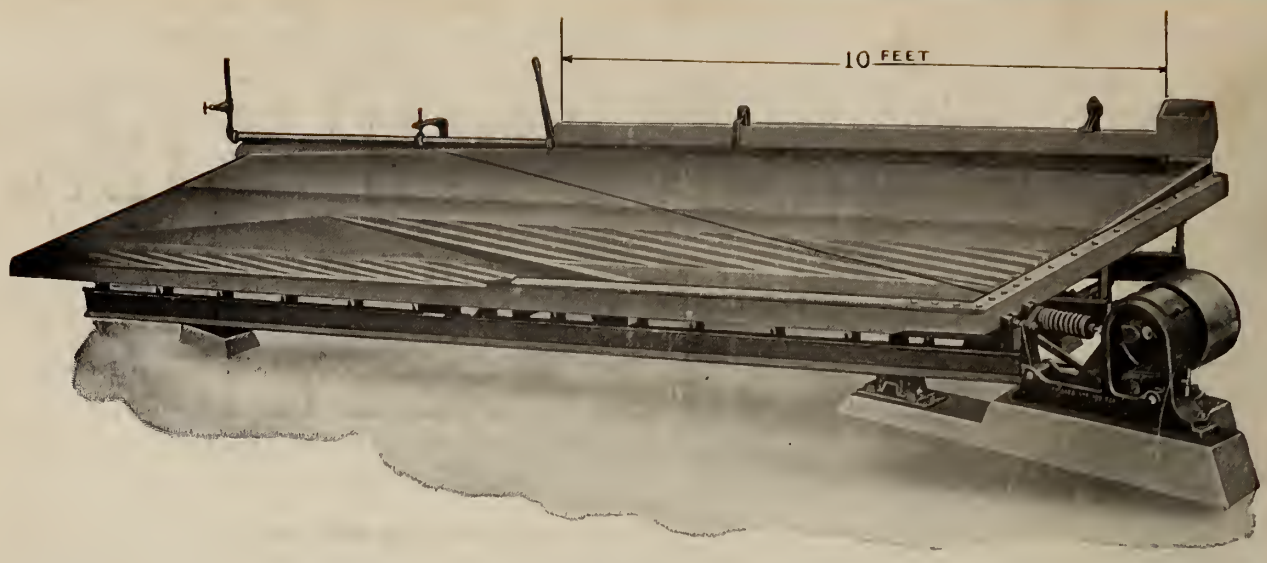
MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.



The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

In
Modern Mining

ECONOMY

Is the Key Note of Success.

USE

CURTIS'S & HARVEY'S EXPLOSIVES

AND

Cut Your Costs

MONTREAL COBALT

MAY 15, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 10

COMPRESSED AIR IS COSTLY

WHY NOT

MAKE A SAVING

BY USING

HARDY SIMPLEX

HAMMER DRILLS?

WE CAN PROVE THIS TO YOU—ASK US HOW

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER 101 Water St.
QUEBEC 31 St. Louis St.
ST. JOHN, N.B. 57 Symthe St.
HALIFAX 78 Granville St.

The Canadian Mining Journal, 2nd Floor, 44-46 Lombard St., Toronto, Ont.

Meeting the Mine Owner's Demands

BYERS GENUINE WROUGHT IRON FULL WEIGHT GUARANTEED PIPE

UNDER the severe conditions of mining usage—with its tremendous pressures in the lower levels, and the constant corrosion of liquids impregnated with acid solutions—Byers Pipe has invariably given the same superior service that is its chief characteristic in other and less exacting installations.

Three generations of mine owners and operators have known this, and have placed Byers as standard in the most heavily worked and economically managed mines since 1864—for air, steam and hydraulic systems and for unwatering operations.

Byers Pipe in mining operations means fewer shut-downs, and materially lowers maintenance costs by reducing bills for repairs and replacements. Its great length of life under the most adverse corrosion conditions renders it particularly efficient in every phase of mining equipment.

The year 1914 marks the fiftieth anniversary of Byers. And the maintenance of the Byers standard of highest quality and hand-controlled methods throughout the industrial fluctuations of half a century is in itself an achievement notable in the annals of pipe history.

Byers passes this milestone with ever-growing prestige, with its reputation based soundly upon the long and flawless record of actual pipe service, and with its facilities increased and made even more efficient than ever before.

Write today for the Byers book—"The Control of Quality in Every Process." It contains valuable information for pipe users.

A·M·BYERS COMPANY

ESTABLISHED 1864

PITTSBURGH, PA.

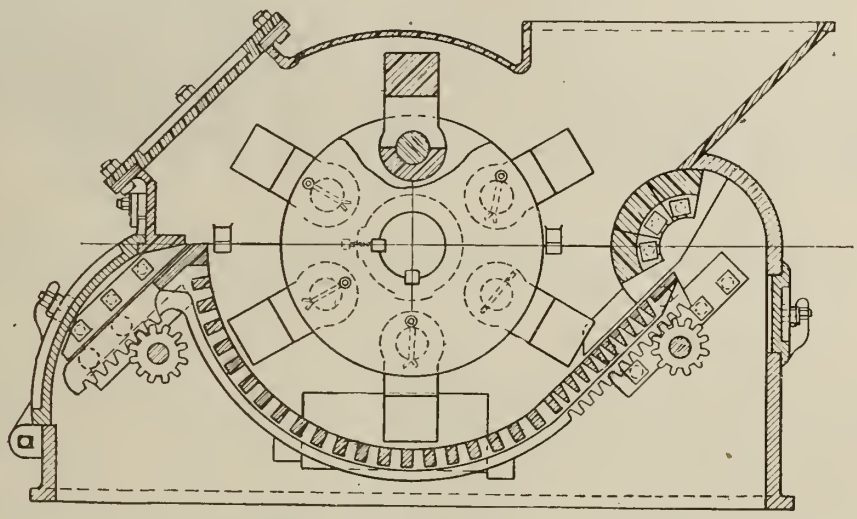
DISTRICT AGENTS AT

New York City	Cleveland	Milwaukee	San Francisco
Boston	Detroit	Cincinnati	Portland, Ore.
Philadelphia	Chicago	Denver	
Buffalo	Toledo	Los Angeles	Dunkirk

Write for the name of the Byers Dealer in your district. He can supply you immediately.

Look for the Byers Mark on every length and coupling.

ROLL HAMMER CRUSHER



This cut represents the **KENNEDY ROLL HAMMER CRUSHER** which is intended for taking rejections from large jaw and gyratory crushers, and breaking to three-quarters inch and finer. When equipped with a grid screen, practically any degree of fineness can be attained, depending on the spacing of the grid bars.

No machine for any purpose has been more carefully developed and designed, nor better material used, than indicated in the following details :

Great weight and strength.
Great flexibility and range of adjustment.
Minimum power required for driving.
Spiders for supporting sub-shaft of CHROME Steel.
Breaker Plates of MANGANESE Steel.
Hammers of MANGANESE Steel.
Cheek Plates of MANGANESE Steel.
Grid Screens of MANGANESE Steel.
Top Housing of MANGANESE Steel.

Kennedy Gyratory and Jaw Crushers; Revolving and Pulsating Screens; Tube Mills and Combination Ball and Tube Mills

Rock & Power Machinery

Limited

Exclusive agency in Canada for the Kennedy Manufacturing and Engineering Co.

HEAD OFFICE: 12 King Street East, Toronto. Ont.

BRANCH OFFICES:

VANCOUVER; MONTREAL; HALIFAX; COBALT; SUDBURY;
AND IN THE KING EDWARD HOTEL, TORONTO

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam** Shovels: Specially Flexible Ropes for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

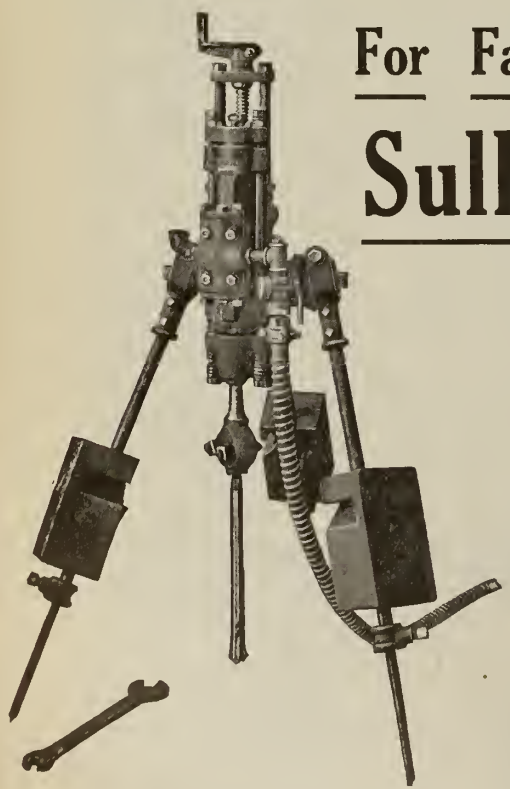
OF THE HIGHEST QUALITY

made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:--

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.



Hammer Drills, Air Compressors, Diamond Core Drills, Coal Cutters, Fans

For Fastest Down-Hole Drilling, Select

Sullivan Air-Jet Drills

No drill can drill faster than it can eject mud and cuttings from the hole. In some rock, one-quarter of the working-time is lost in cleaning or pumping out the mud.

Sullivan Air-Jet Drills discharge exhaust air or steam through their hollow piston and hollow steel to the bottom of the hole, cleaning it of sludge, as rapidly as this is formed, and increasing drilling speed from 25 to 100 per cent.

A water-jet attachment may be added, if desired, for drifting.

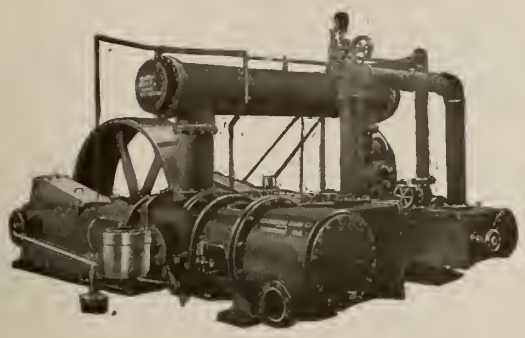
These are some of the features that make Sullivan Drills cost us more to build. They cost you less to use.

Bulletin 666H

SULLIVAN MACHINERY COMPANY

122 So. Michigan Ave. CHICAGO

MONTREAL COBALT NELSON VANCOUVER



APPEARANCE

THE superficial appearance of an air compressor has very little relation to its satisfactory, reliable or efficient performance.

It is a comparatively easy matter to design a fine appearing machine but what you want is a machine that will deliver its full capacity of compressed air at the desired pressure on the minimum of power, and continue to deliver the same amount of air without increased power. You don't want to pay big repair bills either. Compressor appearance is much the same as personal appearance, it's an asset, but it rarely, if ever, earns a dividend.

In the compressor you buy you want dividend earning power plus uninterrupted service and you want that feeling of safety that goes with a thing of genuine first quality.

Ingersoll-Rand compressors will deliver their full volume of compressed air at their rated pressure on as little power as the present science of compression considers practical. They will continue to deliver their original volume on the same amount of power without falling off in efficiency because they are built to give permanent satisfaction and to be permanently economical.

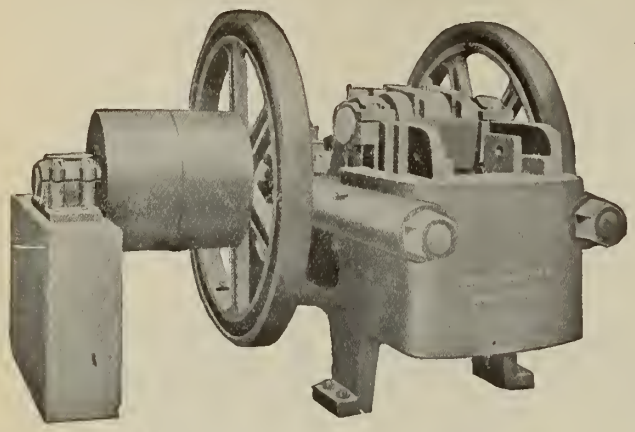
No other builders have carried out such exhaustive tests to determine the qualifications of materials. No other builders have adopted such extensive facilities for treating and improving metals to insure the maximum service from all parts and the permanent operation of the combined parts as a unit.

These precautions add nothing to a machine's appearance but they add to a user's dividends because in the end they save many times their cost, in power and repairs.

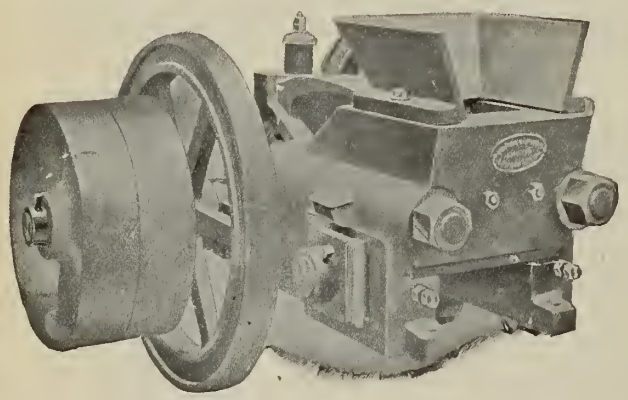
Just remember in buying, that Ingersoll-Rand compressors are used where permanency and reliability are essential.

CANADIAN INGERSOLL - RAND CO.
LIMITED
COMMERCIAL UNION BLDG., MONTREAL, CAN.
WORKS: SHERBROOKE, QUE.

SYDNEY TORONTO COBALT SOUTH PORCUPINE WINNIPEG LETHBRIDGE NELSON VANCOUVER



Blake Crushers from 7" x 9" to 24" x 48"



Dodge Crushers from 4" x 6" to 11" x 15"

Blake and Dodge

CRUSHERS

The Blake Crusher is one of the best known and most successful of the moveable jaw type of crusher. As compared with a gyratory crusher, the Blake Crusher is much less expensive in first cost, upkeep and attention is considerably less, and the work even more satisfactory. These crushers are suitable to crushing down to one-inch cubes. Built of best material and workmanship throughout, and of a heavy type, these crushers will stand the most severe service.

The Dodge Crusher is a thoroughly reliable and practical machine. It possesses practically the same advantages as the Blake machine with the exception of being built somewhat smaller. Its use is specially advantageous when fine reduction is to be accomplished by a single crushing machine. The material and workmanship entering the construction of these machines are equal in every respect to that employed in our Blake machines. A special feature of the Blake and Dodge Crushers is that they are fitted with tie rods across the jaws to prevent breakage.

Crushers of all sizes carried in stock

Write for catalogues

FRASER & CHALMERS

OF CANADA, LIMITED

4 Phillips Place, MONTREAL

MORGAN BATTERSEA CLAY GOODS

Muffles, Crucibles, Scorifiers, Cupels, Furnaces, Etc.

Known the world over as best, having certain features which ever commend them to all users of high-class goods.

MORGAN PLUMBAGO CRUCIBLES

For melting Gold, Silver, Copper, Steel and other metals, are of superior quality, have great uniformity and are favorably known for their power of resisting extreme heat without the danger of craeking from sudden changes.

CHLORIDE OF LIME

Needed for the Spring clean up. In drums, barrels, kegs and smaller packages.

WAUGH STOPING DRILLS

Manufactured by the Denver Rock Drill Manufacturing Co., Denver, Colorado

THE MODEL 16V WAUGH STOPER

is carried in stock by us and sold with the guarantee that it will do more work for you than any other stoper you have or can get. Proved the best by many tests. Write for information and prices.

THE GEORGE TAYLOR HARDWARE CO. LIMITED

NEW LISKEARD (Head Office) **COBALT** **COCHRANE**

YOUR Filtration Clarification Precipitation COSTS

CAN BE REDUCED
BY THE

MERRILL PROCESSES

Zinc Dust Precipitation
Automatic Sluicing Slime Filters
Direct Press Leaching Process (for Gold and Copper Ores)
Automatic Sluicing Clarifying Filters
Concentrating Cones

IF YOU ARE INTERESTED SEND FOR OUR CATALOGUE

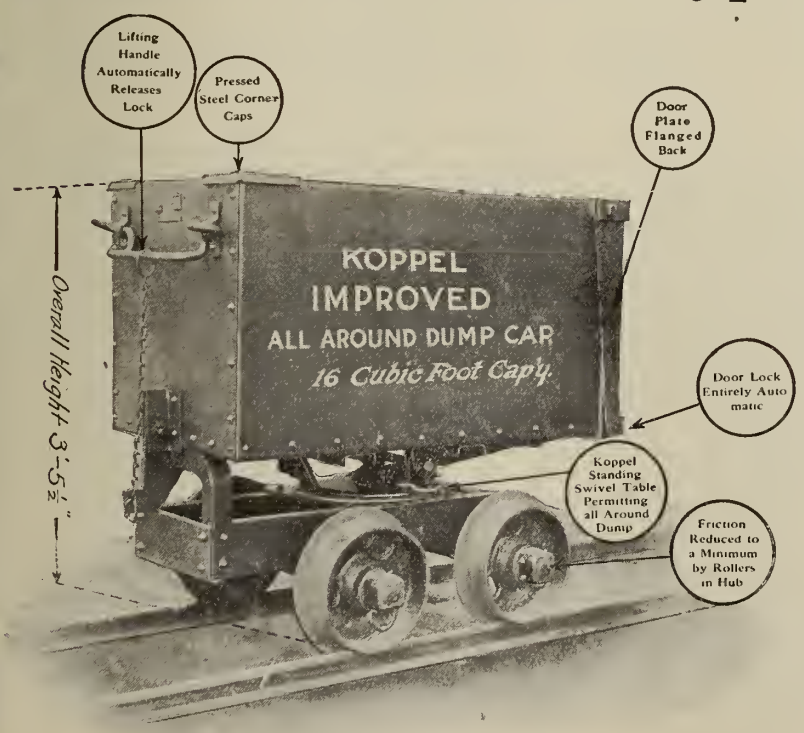
MERRILL METALLURGICAL COMPANY

Cable Address : LURCO.

SAN FRANCISCO, CAL., U.S.A.

CODES { Bedford McNeill / Moreing & Neal

Koppel Improved Type of All Around Dump Car


Lifting Handle Automatically Releases Lock
Pressed Steel Corner Caps
Door Plate Flanged Back
KOPPEL
IMPROVED
ALL AROUND DUMP CAR
16 Cubic Foot Capy.
Overall Height 3'-5½"
Door Lock Entirely Automatic
Koppel Standing Swivel Table Permitting all Around Dump
Friction Reduced to a Minimum by Rollers in Hub

This type of car is especially adapted for mine service.

The swivel table permits all around dumping. It is a very easy running car as the friction is reduced to a minimum by rollers in the hubs of the wheels.

We construct these cars for 12 and 16 cu. ft. capacity and for 18 or 24 inches gauge. They are carried in stock at Koppel, Pa.

Our catalogue on "Koppel Railways in Mines" will be of interest to you.

Ask for Catalogue 409

ORENSTEIN-ARTHUR KOPPEL COMPANY

SALES AGENTS

The Canadian Fairbanks-Morse Company, Limited

ST. JOHN QUEBEC MONTREAL OTTAWA
TORONTO WINNIPEG
SASKATOON CALGARY VANCOUVER

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

Montreal to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 583 Main Street, Winnipeg, Man. 52 King St. E., Toronto, Ont.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

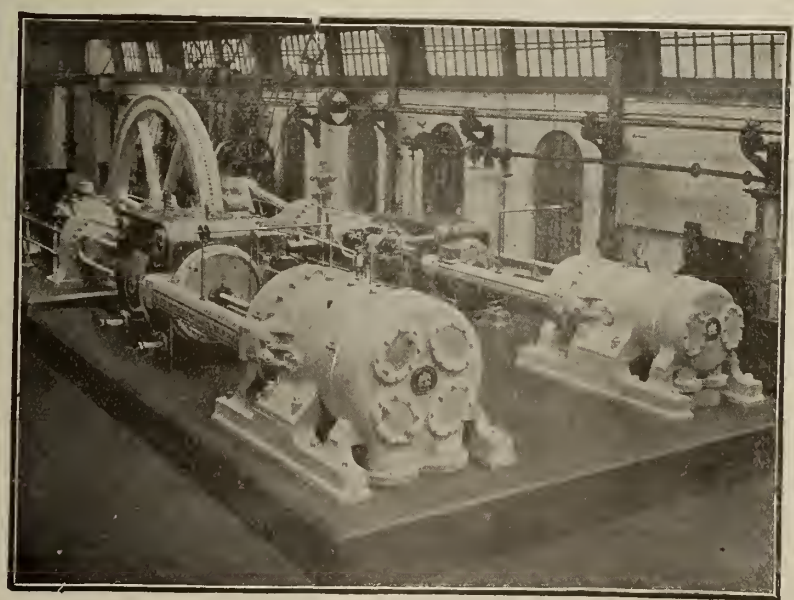
THE SUPREME METAL
FOR WEARING PARTS

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries

Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

FOR SALE

Steam Hoisting Engines and Pumps

The following machinery has been put out of service by an electric installation and is offered for immediate delivery, f.o.b. cars Stellarton, Nova Scotia.

1 Novelty Iron Works Steam Hoisting Engine. Duplex cylinders, 16″ diameter by 42″ stroke. Geared to 2 cast iron drums 9′ diameter by 56″ wide. Gear ratio 3 to 1, also 6,500′ of 1″ steel cable.

1 I. Matheson and Company's Steam Hoisting Engine, duplex cylinders, 16″ diameter by 30″ stroke. Geared to 2 cast iron drums 9′ diameter by 54″ wide. Gear ratio 2.4 to 1.

1 Jeansville Duplex Triple Expansion Pumping Engine, Steam cylinders 19″, 27″ and 44″ diameter, by 36″ stroke. Water cylinder 9″ diameter, together with jet condenser and condenser pump. Outfit capable of handling 1,000 gallons per minute against 1,800 feet head. Very low prices.

Address
Acadia Coal Company, Limited,
Stellarton, N.S.

ELECTRIC STEEL CASTINGS

Our Welland Plant will be ready to furnish Carbon, Manganese, Alloy Steel Castings and Forging Ingots by the end of May, made by the Electric Furnace Process. This process makes a dependable high-grade Steel and Steel Castings, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars.

THE ELECTRIC STEEL & METALS CO., LIMITED
WELLAND - ONTARIO

Shot Blocks Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.
43 Exchange Place — New York

ALSO
Electrolytic Nickel
(99.80% Pure)

This Roofing Never Costs a Cent for Maintenance

It's false economy to put your money in a "cheap" roofing that has to be painted, regraveled or repaired every year or two. The ***real*** cost of a roofing is the ***purchase price*** plus the ***cost of maintenance.***

J-M Asbestos Roofing is the only ready roofing that never requires a single cent's worth of coating, graveling, or other protection. Therefore ***it costs less per year of service*** than any other roofing.

This roofing never needs any protection, because it is made of layers of stone (Asbestos) felt securely cemented together with Trinidad Lake Asphalt. It is ***mineral through and through***—literally a sheet of ***pliable stone.*** There isn't a particle of perishable material in

J-M ASBESTOS ROOFING

Is it any wonder that this stone roofing is not affected by rain, heat, cold, salt air, chemical fumes, etc., and that it affords absolute protection against fire? And is it any wonder that this roofing is still in good condition on hundreds of buildings after more than 25 years of service?

J-M Asbestos Roofing comes in rolls ready to lay; also furnished in built-up form. Suitable for any type of building. Easy to lay. J-M Roofing Cleats, packed in each roll, make absolutely water-tight laps and give the entire roof a handsome white appearance. Your dealer sells J-M Asbestos Roofing—if not order from our nearest branch.

We are also prepared to furnish J-M Regal Roofing which although low in price is the highest grade rubber roofing on the market.

Write for sample of the Curious Asbestos Rock from which this Roofing is made and illustrated Catalog. 1967

The CANADIAN H. W. JOHNS-MANVILLE CO., Limited

Manufacturers of Pipe Coverings: Packings; Mastic Flooring; Conduit; Stack Lining; Fireproof Paint; Fire Extinguishers, Fuses, etc.

TORONTO MONTREAL WINNIPEG VANCOUVER

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

LYMANS, Limited

MONTREAL

Headquarters for—

Balances
Crucibles
Crushers
Furnaces
Bone Ash
Borax
C.P. Acids and Chemicals
Etc., Etc.

Assay Supplies
Largest Stock in Canada

Assay Supplies
Largest Stock in Canada

Genuine Satisfaction

If you have anything to do with Rock Drills, you have, probably, been disgusted with them many times and wished you were running by hand. You are striving for fewer delays, lower mining costs, increased tonnage, and increased profits, and cannot afford to leave anything untried which would aid in the attainment of the above.

Can you afford therefore to pass by

THE

"CLEVELAND" STOPE DRILL

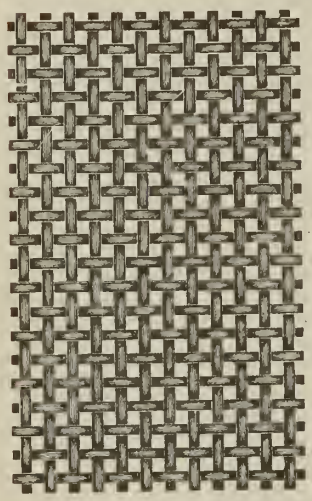
and not give it a trial when we can guarantee that it will relieve you of this part of your troubles.

There are so many reasons "why" that we haven't space enough here to enumerate them, but will you please

Write for Bulletin No. 30.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street - TORONTO

SCREENS



FOR

All kinds of Mining Work and Cement Mills

Wire Cloth, Square or Oblong Mesh, and Perforated Metals for all kinds of revolving or flat screens.

MANUFACTURED BY

The B. GREENING WIRE CO., Ltd.

HAMILTON, ONT. MONTREAL, QUE.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 1 4" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: **NEW GLASGOW, NOVA SCOTIA**

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

Imperial Bank
of Canada

Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Subscribed	$7,000,000
Capital Paid Up	7,000,000
Reserve Fund	7,000,000

Branches in Northern Ontario at

Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

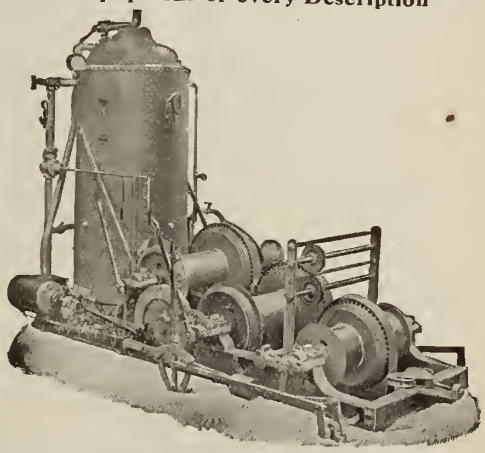
Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

BEATTY

Hoists, Clamshells, Derricks and Material Handling Equipment of every Description



Standard Two-Drum Hoist with Swinger.

Engines for every kind of hoisting duty.

BEATTY PLANT

on your work means uninterrupted service and complete satisfaction.

SEND FOR CATALOGUE, TO-DAY!

M. BEATTY & SONS, Limited

Welland - Ontario

AGENTS: H. E. Plant, 1790 St. James St., Montreal. H. W. Petrie, Ltd., Toronto. Rob't. Hamilton & Co., Vancouver, B.C. E. Leonard & Sons, St. John, N.B. A. R. Williams Machinery Co., Winnipeg.

SUPPORT HOME INDUSTRIES

THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records

Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

THE CANADA METAL CO., LIMITED

HEAD OFFICE AND FACTORY **TORONTO** BRANCH FACTORIES **WINNIPEG** AND **MONTREAL**

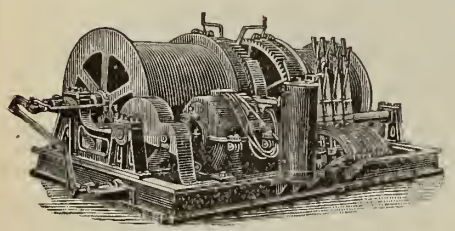
Flory Hoisting Engines

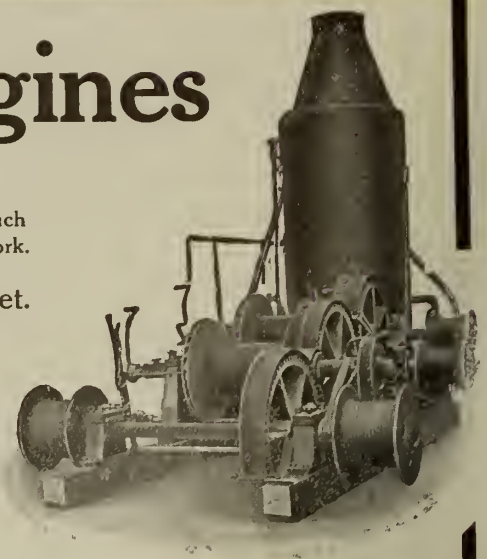
STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

Slate Mining and Working Machinery.





SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.

S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

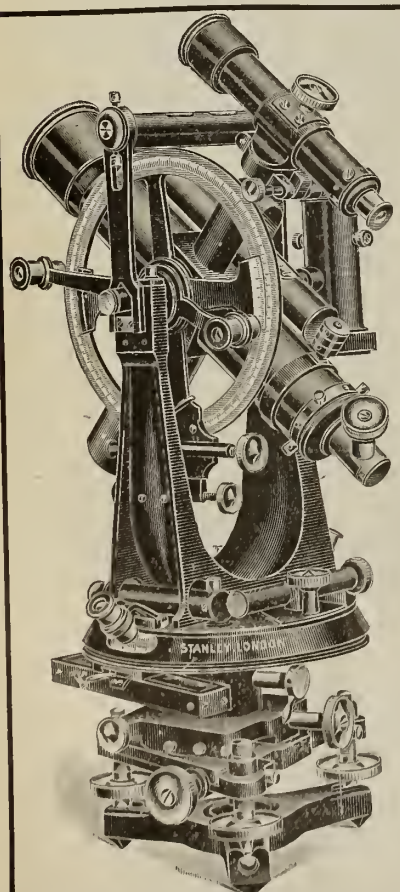
Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL



Stanley's Dunbar-Scott Auxiliary Top and Side Telescope. Requires no correction for eccentricity.

Trade
STANLEY
Mark

The largest manufacturers of

SURVEYING and DRAWING INSTRUMENTS in the world.

DRAWING OFFICE STATIONERY of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our "K 35" Catalogue (post and duty free) and compare our prices with those of other first-class makers.

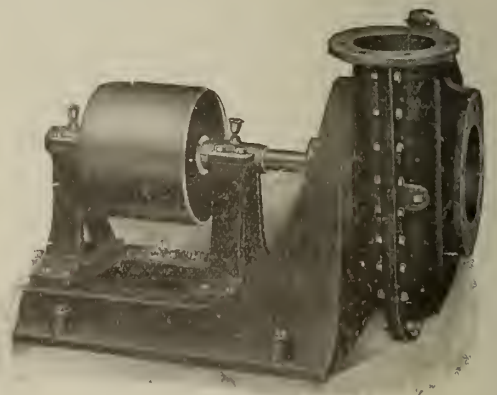
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, High Holborn, W.C.

Head Offices and Showrooms:
286, High Holborn, London, W.C., Eng.

What more can be desired for the use of your money than first-class workmanship and material?

This is what you get when you buy from



The Smart Turner Machine Co.
LIMITED
Hamilton, Canada

Printing!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets.
Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm. Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

THE DAILY
Journal of Commerce

CANADA'S ONLY DAILY FINANCIAL NEWSPAPER

HON. W. S. FIELDING, President and Editor-in-Chief.
J. C. ROSS, M.A., Managing Editor
J. J. HARPELL, B.A., Secretary-Treasurer and Business Manager.

Special Wire to New York and Special Cable Service to London

Canada to-day has a yearly trade in excess of one billion dollars, while hundreds of millions of dollars of British and foreign capital is pouring into the country for investment. The country's banking institutions, her mining companies, her investment houses, her transportation systems, her manufacturing industries, her insurance companies and commercial houses compare favorably with those of any other country in the world. While the JOURNAL OF COMMERCE naturally deals chiefly with matters of finance and commerce, its news columns are by no means confined to that class of information. The general news of the day is covered in a condensed form and our aim is to present the very latest news concerning all important affairs. Whatever may be the important event of the moment, in any part of the world, it is promptly reported by the JOURNAL'S staff of correspondents.

Reliable News of all the Industries

Every person interested in Canadian Investments should be a Subscriber

SAMPLE ON REQUEST - - - SUBSCRIPTION PRICE, $5.00 PER ANNUM

Published Daily by

The Journal of Commerce Publishing Co., Limited

MONTREAL

Toronto Office: 44-46 Lombard St.

MINE RAILS

12 to 45 Pounds

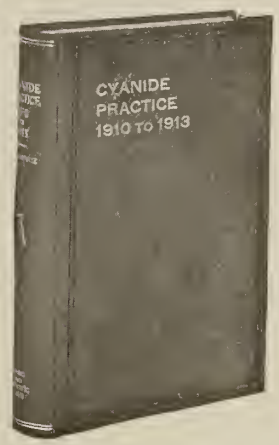
PROMPT SERVICE.

H. A. DRURY CO.

LIMITED

MONTREAL and TORONTO

CYANIDE PRACTICE 1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.

140 illustrations

Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings:

Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade managanese ore occur at a number of different localities.

Tungsten-bearing ores of good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

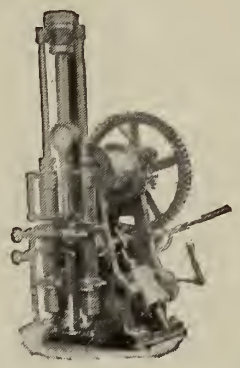
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. **NEW YORK**

POSITION WANTED

As superintendent or foreman, by one who has had wide experience in Mechanical Construction, Draughting, Designing and Erecting of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc. References. Will accept small salary until value of services is demonstrated.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

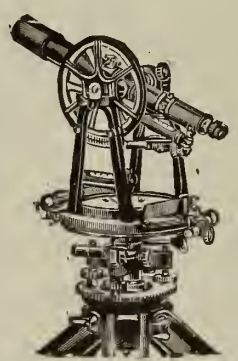
ALWAYS IN STOCK,

MORRIS CHAIN BLOCKS

THEY NEVER BETRAY.

THE HERBERT MORRIS CRANE & HOIST COMPANY, Limited

EMPRESS WORKS, PETER STREET, TORONTO.



Berger TRANSITS AND LEVELS

Latest designs in Instruments for Underground Surveying for all classes of work. Complete Catalog fully describing and illustrating these instruments, with **a large Manual giving full and concise directions** in the **care, use** and **adjustment** of instruments will be sent on request.

C. L. Berger & Sons, Boston, Mass., U.S.A.

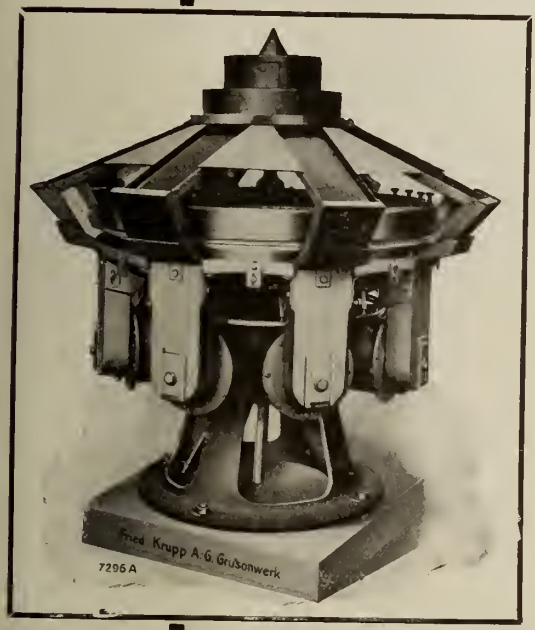
DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

"ULLRICH"
PATENT ELECTRO MAGNETIC WET & DRY SEPARATORS



treat all Kinds of strongly and weakly magnetic ores in one operation.

Ullrich's Patent Electro Magnetic Separators

have solved the problem of treating weakly magnetic ore under wet conditions; are the only machines with adjustable magnetic field zones, thus being applicable to difficult complex ores; treat coarse ore as well as slimes; have been introduced in many mines with highly satisfactory results.

The more difficult the ore, the more conspicuous the merits of the Ullrich Separator in capacity. simplicity and actual results.

Large Experimental Works for Concentration—and Magnetic Separation Tests

FRIED. KRUPP A.-G GRUSONWERK, MADGEBURG (GERMANY)

Canadian Representatives: JAS. W. PYKE & CO., LIMITED, 232 ST. JAMES STREET, MONTREAL

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

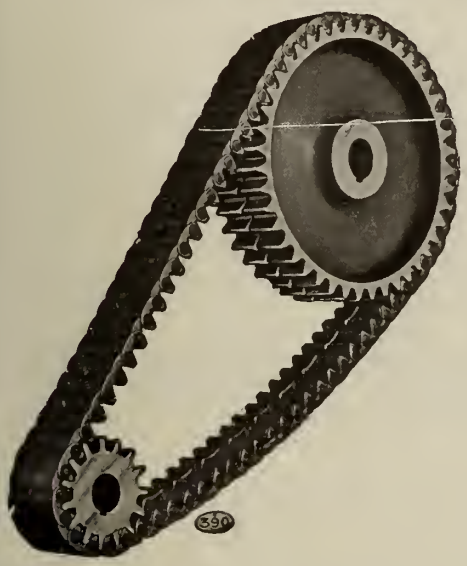
B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD PATENT SILENT CHAINS



The advantages are :—

Saving in Space

The chain drive only occupies one-third of the space occupied by the belt, as with chain drive it is possible to place the motor close to the shaft without any sacrifice of efficiency.

Saving in Power

Chain Drives being positive, there is no initial tension as with belts, and therefore none of the journal friction so caused. Consequently all the power is applied economically.

Regularity of Output

With the chain the speed ratio is perfectly definite under all conditions of load. This ensures a steady output with not only an increase in quantity but generally an improvement in quality.

Many other advantages given in illustrated catalogue sent on request.

JONES & GLASSCO (Reg'd) Engineers

Sole Canadian Agents

Branch Office, Toronto **49 Place D'Youville, MONTREAL**

TEMISKAMING AND NORTHERN ONTARIO RAILWAY

(ONTARIO GOVERNMENT RAILWAY)

SIR JAMES P. WHITNEY, Premier

Toronto, Montreal through Sleeping and Dining Cars to Timagami, Cobalt, Englehart, Elk Lake, Porcupine, Cochrane, traversing the far-famed Timagami Lakes---the Sportsmen's Paradise.

Through the rich and well-known Cobalt silver and Porcupine gold districts. Through the great clay belt---20,000,000 acres of rich agricultural lands await the settler.

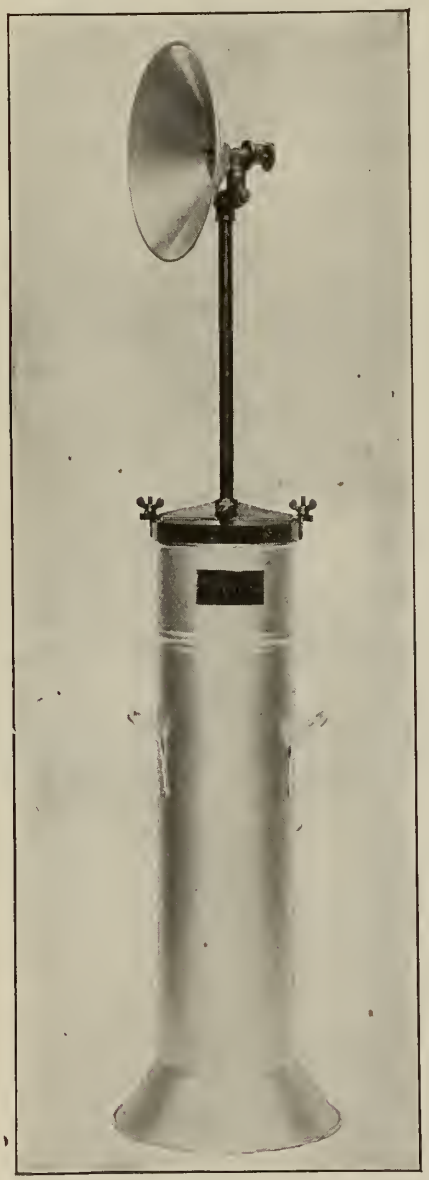
For full information, pamphlets, time tables, etc., apply:—

GEO. W. LEE,
Land Commr.,
North Bay, Ont.

A. J. PARR,
G. F. & P. A.,
North Bay, Ont.

A. J. McGEE
Sec.-Treas.
Toronto, Ont.

THE LIGHT FOR THE MINE



FIVE CENTS

PAYS FOR

2000 CANDLE POWER

FOR ONE HOUR

THE

CARBIC LIGHT

Is the Cheapest, Simplest and Most Efficient Light, of Its Kind, on the Market. . . . Absolutely No Waste, Non-Explosive, Easily Handled, and Will Stand Rough Usage. Carried in Stock.

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, May 15, 1914. No. 10

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor

REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

	Page.
Editorials—	
The Observation of Mining Regulations	325
Mining Accidents	326
Dome Mines Annual Report	327
Microscopic Characters of the Ore Deposits and Rocks of the Kirkland Lake District, Ontario. By Charles Spearman	329
Treatment of British Columbia Zinc Ores	333
The Mining Society of Nova Scotia. By F. H. Sexton	337
La Rose Consolidated Mines. By R. B. Watson	338
Iron Ore Deposits, Bathurst Mines, N.B. By G. A. Young	339
The Minerals Separation Decision	340
Copper Leaching and Electrolytic Precipitation at Chuquicamata, Chile. By E. A. Cappalen Smith	341
The Weight of Rand Stamps	342
Modern Rock Drills. By P. B. McDonald	343
Book Reviews	348
Proposed T. & N. O. Railway Extension to James Bay. By J. G. G. Kerry	349
The Vertical Range of Metals Deposited by Secondary Processes. By W. H. Emmons	353
Personal and General	355
Special Correspondence	356
Markets	360

THE OBSERVATION OF MINING REGULATIONS

The tendency to ignore regulations which interfere with the easy carrying on of operations is common to all industries. Regulations affecting mining have been drawn up after careful consideration by specialists and yet everyone knows that many of the regulations designed to protect the workmen are not properly observed. The fault is sometimes with the employer and sometimes with the employee.

In a recent report Mr. T. F. Sutherland, Chief Inspector of Mines of Ontario, calls attention to the present condition of affairs. He says:

"The investigations by this Department into many of the accidents during the past year show a non-observance of the Mining Act by some operators and many employees, and emphasize forcibly the need of further Government supervision. The Mining Act is wide in its requirements, and penalties are provided for non-observance. Infringements have to be proven in court on information laid by the Inspector. The policy so far followed has been to take action only in flagrant cases where life has been endangered. Thus, it is only after an accident has happened that a prosecution follows. The result has been that, in several instances, mine operators have taken chances with dangerous conditions, trusting that they could get through without an accident and have the work completed before an Inspector visited them. The men under ground handle powder carelessly, drill into old bottoms, and follow other dangerous practices, knowing that, if caught by the foreman, the worst that will happen is to be discharged, and they know that they can go to the next mine and obtain employment. Foremen rarely report an infringement of the Mining Act to the Inspector. The result is that careless and reckless workmen drift from mine to mine, endangering their own safety and that of their fellow workmen.

"If only licensed men were allowed to be in charge of actual mining operations, and if the holding of such a license depended upon the safety of the mining methods followed, it would tend to decrease the high accident rate of the mines of Ontario."

Proper appreciation of the danger involved is the first necessity. Workmen grow careless and take undue risks. It is the duty of those in charge to prevent such carelessness if they can. The reports of the mining inspectors of various parts of the country show that most accidents are avoidable.

MINING ACCIDENTS

The quarterly report of the Chief Inspector of Mines of Ontario, part of which is reproduced in this issue of the Journal, shows that there are very numerous accidents in quarries, gravel pits, clay banks, and other works that are not as well superintended as are underground workings. There are so many small quarries and pits that it is difficult to gather data concerning them all; but the department has made good progress so far. The information gathered shows that stricter regulations concerning operations of this kind are necessary if accidents are to be avoided.

The fatal accidents at mines during the three month period numbered eight. This is a fairly small number compared with 45 fatal accidents during the preceding 12 months. A very noteworthy feature is the splendid record obtained by two of the companies which have adopted special inspection systems of their own.

The Beaver Consolidated Co. employs an inspector who makes a daily round of all the working places and makes very complete reports as to the conditions obtaining. Prompt attention is given to his recommendations, and as a result the company has few accidents. The system so successful at the Beaver has been put in force recently at the Temiskaming mine.

The Canadian Copper Co. has found that the establishment of a Safety Department with a safety specialist in charge has been a complete success. The showing made by this company since the appointment of Mr. E. T. Corkill is a remarkably good one.

Those who have charge of mining operations will do well to insist on the exercise of every precaution to prevent accidents. The men at work should be confident that the management is doing everything possible to make the work safe. It is in the interest of both employer and employee that safety be considered first.

The strict enforcement of the laws regulating mining operations and the adoption of systems of inspection such as those at the mines of the Beaver Consolidated Company and the Canadian Copper Company would make mining a safer occupation. Recognition of the danger too often comes too late.

A DAILY FINANCIAL PAPER

Canada now has a daily financial paper, the first issue of the daily Journal of Commerce having appeared on May 5. It is a very creditable paper, and with Hon. W. S. Fielding as editor-in-chief, and Mr. J. C. Ross as managing editor, will soon find its place among the leading financial dailies of the world. For some years Canada has had weekly financial papers. There is now room for a daily. Those who are interested in Canadian investments of any kind will appreciate the improved service offered by the Journal of Commerce.

CROWN RESERVE.

Montreal, May 6.

The action, Black vs. the Crown Reserve Mining Co., dismissed this morning by the Privy Council with costs against Black, confirms the judgment of all the Canadian courts that have heard the case.

The case, which has just been decided in London, and in which mining circles in Canada have been greatly interested, was an appeal from a judgment rendered by the Court of King's Bench on October 31st, 1912, confirming a judgment of the Superior Court of the 28th June, 1912, by which all of the Canadian Judges dismissed the action taken by John Black and others to obtain from the Crown Reserve Mining Co., John Carson and others, an accounting for 569,950 shares of the capital stock of the Crown Reserve Mining Co. alleged to be held by them in trust, and praying for judgment in favor of each of the appellants for his share of the balance of his stock.

This litigation has been pending before the courts in one form or another between five and six years, three suits having been previously taken by other parties interested, in the form of injunctions and other proceedings, in order to attack this stock, referred to in the present action.

The result of the judgment now confirmed is that the position taken by Colonel Carson and the Crown Reserve Mining Co. is fully justified by the courts, and John Black and the others interested with him are condemned to pay the costs in all the courts.

Previous to the institution of any of the litigation herein, the Crown Reserve Mining Company had for the purposes of the company disposed of about 338.807 shares of the company's stock. This transfer also was attacked by the appellants.

It is now finally decided and the shareholders of the Crown Reserve Mining Co. will be gratified to know that the 231,143 shares now held by the trustees are now declared by the highest court to be the property of the company beyond danger of attack, and the sale already made by the company is ratified.—Journal of Commerce.

CANADIAN PEAT CO.

The Canadian Peat Company, Limited, capitalized at $250,000 is offering 650 shares of preferred stock, bearing interest at the rate of seven per cent., at par. The company has property located at Alfred, Ont., on which machinery for the production of peat fuel has been in operation for some time. It is now proposed to instal additional machinery and enlarge the scope of the company. The secretary-treasurer of the company, H. Poynter Bell and the manager, E. V. Moore, are the vendors of the company. Both of these gentlemen are experts in matters pertaining to peat.

The directors of the Canadian Peat Company Limited, are: J. W. Sutherland, Hamilton; M. Chapman, Toronto; G. A. Howell, Toronto; H. Poynter Bell, Toronto; G. C. Campbell, Toronto.—Financial Times.

DEPARTMENT OF MINES PUBLICATIONS.

The Geological Survey has recently issued the following:

Map 29A, topographical map of part of Simcoe and Ontario counties, Ontario.

Map 101A, geological map of St. Hilaire and Rougemont mountains, Quebec.

Map 99A, geological map of southern portion of Cranbrook map-area, British Columbia.

Memoir 44. Clay and shale deposits of New Brunswick, by J. Keele.

DOME MINES ANNUAL REPORT

The report of the Dome Mines, for the year ending March 31, which has just been issued, is the most complete statement yet published by the company, and gives full information regarding operations, ore reserves and costs.

During the year ending March 31st, 1914, there was mined a total of 163,177 tons. Of this amount, 144,281 tons was ore sent to the mill, of which 121,800 tons came from the open pits, 4,782 tons from third level stopes at No. 2 shaft and 17,699 tons from development. There was milled a total of 145,305 tons, from which was made a net recovery per ton of $8.29, or a total of $1,204,597.64. In addition to this, $2,694.83 was realized from interest, discount and exchange. During the year, the following amounts were spent:

DOME MILL AND CYANIDE PLANT

Expenditures During the Year.

Operating	$453,965.70
Development	161,547.76
Plant and equipment	303,999.02
Total	$919,512.48
Balance	287,779.99
	$1,207,292.47

On March 31st, 1913, the excess of current liabilities was $55,138.24, while the net current assets over current liabilities now stands at $237,117.82, in addition to an accident fund of $4,476.07, and the enlarged plant.

The balance of general development as at March 31st, 1913, amounting to $342,403.48, has been written off against surplus, while current development during the year amounting to $161,547.76 has been written off against current revenue as an operating cost. While this step is somewhat drastic, it permits the company to start with a clean sheet.

The operating cost for the year, excluding all development charges, was $3.084 per ton, which represents a decrease of $1.49 per ton as compared with the cost during the previous year. This improvement is due to the use of hydro electric power, larger tonnage milled, and increased efficiency of methods. The consulting engineer states that the working costs will be further reduced and should be less than $2.50 per ton when the enlarged plant is in operation.

Development work—Practically all development work has been done at No. 2 shaft in opening the third, fourth and fifth levels, and in further shaft sinking. The most extensive development was on the third level, where a large body of ore equivalent to a horizontal area of 100,000 square ft. has been disclosed. This was defined by 859 ft. of drifts and 969 ft. of crosscuts, the sampling value being $3.49 per ton.

On the fourth and fifth levels only a small amount of development work has as yet been done, but this work shows further areas of ore. The fourth level shows 29,480 square ft., determined by 539 ft. of development, with an average sampling value of $4.03, and the fifth level shows an area of 37,000 square ft., determined by 644 ft. of development, with a sampling value of $4.94 per ton. A much greater amount of development, however, will have to be done on the fourth and fifth levels before any safe estimate of the probable size or value of the ore body can be attempted.

A certain amount of diamond drilling was done at No. 2 shaft, and in addition, six holes were put down west of the "Dome" outcrop, with results that warranted the extension of a drift from the 100 ft. level to develop this new area.

The expenditures for development during the year were largely in excess of normal requirements, and this excess development has been a direct charge on current operations. The total amount expended equals $1.11 per ton milled during the year, but when figured against ore developed, the charge will be very small.

The annual report of last year, showed 315,000 tons, averaging $7.53 above the 45 ft. level and 250,000 tons of undetermined grade between the 45 and 100 ft. levels. During the past year, there has been taken from this 121,800 tons averaging $9.24.

Ore Reserves.—Upon applying a definite value to ore of undetermined grade, which was previously considered incompletely developed ore, and upon including certain additional small tonnages, the balance now remaining above the 100 ft. level stands at a total of 512,600 tons, averaging $4.81 per ton. In addition to this tonnage of fully developed ore, there has been indicated an additional tonnage which is partially developed, amounting to 2,000,000 tons, averaging $3.50 per ton. Development work now extends along the strike of the formation for a distance of 1,250 ft.

Exploration.—The results of diamond drilling from holes bored to the east and below the present development on the fourth and fifth levels, indicate additional large bodies of low grade ore for which no credit has been taken in the tonnage estimated. In addition,

two surface trenches to the west of the open pits, showed a width of 234 ft., averaging $3.82.

In the No. 4 shaft section, six diamond drill holes put down within an area of 15,000 square ft. indicated a new ore body, which will be developed from the 100 ft. level.

Plant.—During the year it was decided to increase the treatment capacity of the plant to 28,000 tons per month, this work necessitating the following expenditures:

Mill	$207,778.83
Mine	19,543.21
Pumping plant	27,185.41
Crusher station	23,236.21
Shops, dwellings and miscellaneous	17,080.46
Power, steam, electric and air lines	15,174.90
	$303,999.02

No. 2 Shaft, Dome Mine

This increase necessitated the installation of an additional 40 stamps and of sand leaching tanks. This modification of the present all sliming practice will give greater economy for the treatment of low grade ore.

The company possesses a deposit of low grade ore, which should be worked by a policy of non-selective mining, and which gives assurance of profitable life on a basis of the new treatment capacity. The advisability of still further increasing the capacity of the mill cannot be satisfactorily determined until further development work has been done from the lower levels of the No. 2 shaft, and until the limit of low operating costs has been firmly established with underground mining conditions.

During the year, a total of 6,579 ft. of drifts, crosscuts and raises were driven and No. 2 shaft was sunk an additional 223 ft.

Efficiency records for the year show that an average of 4.023 tons was produced per man per shift for all underground employees and 1.73 tons per man per shift for the total number of employees on the property. The stoping record shows 43.7 tons broken per machine shift, with the large piston drills and 61.01 tons per machine shift for the small machines. In the mill 60.7 per cent. of the total value was recovered by amalgamation and 39.3 per cent. was recovered by cyanidation, while the average stamp duty was 10.6 tons per 24 hours. The average recovery was 94.5 per cent.

Operating costs of $3.08 were distributed as follows:

Mining	.68
Hoisting	.07
Crushing and conveying to mill	.25
Stamping, tube milling and amalgamation	.86
Thickening, cyaniding and precipitating	.50
Refining	.08
General	.64
Total	$3.08

It is expected that the item of 25c for crushing and conveying to mill will be reduced to 10c. Compared with the previous year, costs of operation are $1.49 less.

The balance sheet shows cash on hand of $168,749.12, while the surplus as of April 1st, 1914, is $486,520.20.

The report of this company leaves little to be desired in the way of information. Of particular interest is the statement that operating costs will be reduced to $2.50 per ton. Previous to the operations on the Dome property, such a cost for any Ontario gold mine was considered absolutely out of the question, and if the company is successful in carrying out its policies, it should have a marked effect on the development of low grade gold properties throughout the Province. Some properties which heretofore have been considered too low grade to be of any interest may now with this encouragement be susceptible of economic development. The establishment of such low costs in Porcupine, where conditions are to some extent unfavorable, reflects great credit upon the management of the property.

The purchasing power of a company of this sort is also an important factor and although it is not likely to be of much interest to the individual shareholders, it is extremely important to the Province as a whole. During the past two years, the company has spent approximately $1,000,000 a year, and with the enlarged plant, the yearly expenditures in the future should be about the same. The benefit of this distribution can hardly be estimated, as the effects are far reaching, but the annual disbursement of such a sum as this by a single company which has, according to its estimates, several years of profitable life before it, and with the possibilities for future development by no means exhausted, will be an important factor in a permanent development of Northern Ontario.

The Granby Consolidated Co. last month sent a number of artisans and much building material to its Midas mine, near Valdez, Alaska, to make provision for accommodation for miners and cover for machinery, preparatory to commencing to ship ore to the company's smeltery at Anyox, Observatory Inlet, B.C.

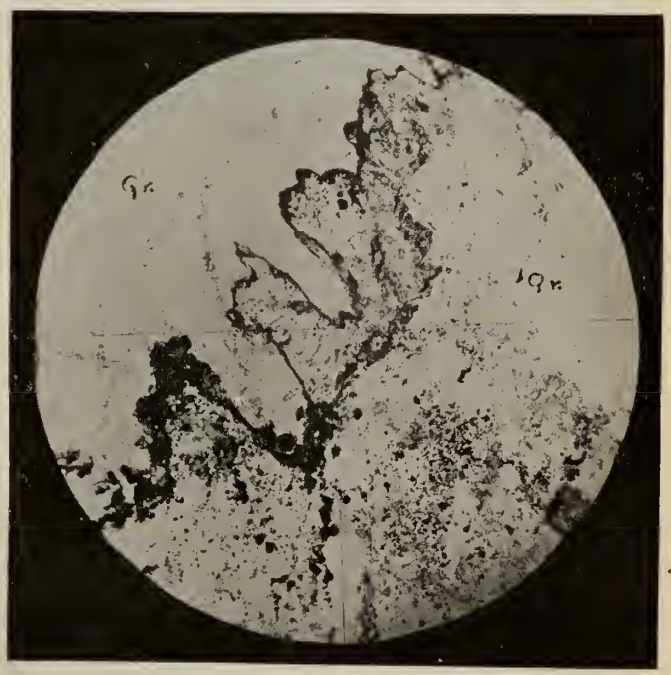
MICROSCOPIC CHARACTERS OF THE ORE DEPOSITS AND ROCKS OF THE KIRKLAND LAKE DISTRICT, ONTARIO

By Chas. Spearman.

The Kirkland Lake district presents an area of great interest to the petrographer as well as to the geologist. The different types of ore bodies, the occurrence of somewhat rare minerals in those ore bodies, the mode of introduction, and the succession of introduction of the various minerals, all afford a field, unique, somewhat complex, and interesting from many standpoints.

A few photomicrographs will probably serve to illustrate some of the more important features of the ore deposits and rocks of the district.

No. 1 x42



No. 2 x42

GOLD ORE, TOUGH-OAKES MINE, KIRKLAND LAKE

Qr. quartz; C. calcite; Al. Altaite; Mo. molybdenite; P. pyrargyrite. White dots represent tellurides.

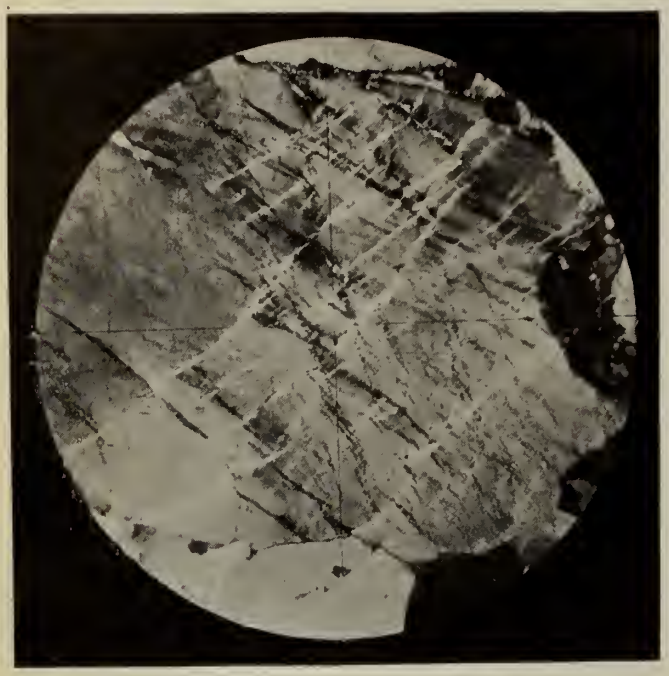
Photomicrograph No. 1, ore from the 100 ft. level of the Tough-Oakes mine, shows gold and altaite encased in pyrite crystals. In the many fractures in the quartz is shown native gold, and tellurides of lead, zinc, silver and gold. In addition to minerals named in previous papers* may be mentioned, the occurrence of the mineral pyrargyrite, ** ($3\ Ag_2\ S.Sb_2\ S_3$), which occurs quite frequently. This mineral appears in the thin sections as having a greyish black color and rather an adamantine lustre. In thin splinters it shows a deep red color by transmitted light. It occurs in very fine grained aggregates, forming dark wavy and irregular lines in the quartz (photo No. 2), and also in disseminated particles. In some of the coarser particles the cleavage and the prismatic structure are plainly visible. Some of the thin sections show this mineral to occur quite abundantly, especially in the "porphyry" type of ore deposit, and in the ore at the contact between the porphyry and the sediments. Molybdenite (MoS_2) occurs frequently, and is associated with the pyrargyrite in the dark bands along fractures in the quartz, and also in isolated particles in the quartz. No argentite was recognized in any of the thin sections examined, and it is probable that pyrargyrite contributes largely to the comparatively high silver values in the Kirkland Lake ores. Occasionally throughout the ore calcite occurs as a secondary mineral.

Photomicrograph No. 2, shows the nature of the dark wavy bands of mineralization, often occurring in the quartz of the deposits. In these bands are found crystallized pyrite, pyrargyrite, molybdenite, and at times the various tellurides and native gold.

*—"Kirkland Lake Gold Deposits," by R. E. Hore, Can. Mining Journal, July 15, 1913, pp. 424-31; "Ore Deposits of Kirkland Lake District," by C. Spearman, Ibid., Oct. 1, 1913, pp. 599-601; "Discussion of Ore Deposits and Geology," by J. B. Tyrrell, J. M. Bell, and A. G. Burrows, Ibid, April 1, 1914, p. 235; "The Tough-Oakes Gold Mine, Kirkland Lake," by R. E. Hore, Ibid, April 15, 1914, p. 259.

**—Several slides made from pannings from typical Kirkland Lake ore showed a few particles of mineral resembling proustite, but being very minute they were difficult to determine.

Photomicrograph No. 3, will convey some impression of the severe pressure to which the quartz of the ore bodies was subjected after deposition. The sections show two series of fractures at about right angles



No. 3 x42

and again others in intermediate directions. In this particular section the fractures are filled with later quartz.

Photomicrograph No. 4, displays an unusual occurrence of pyrite. The pyrite is massive, with a border of very delicate radiating aggregates, or groups resembling millerite. This occurrence is within the calcite only, and not in the quartz.

Photomicrograph No. 5, shows the structure highly magnified.

No. 4 x42

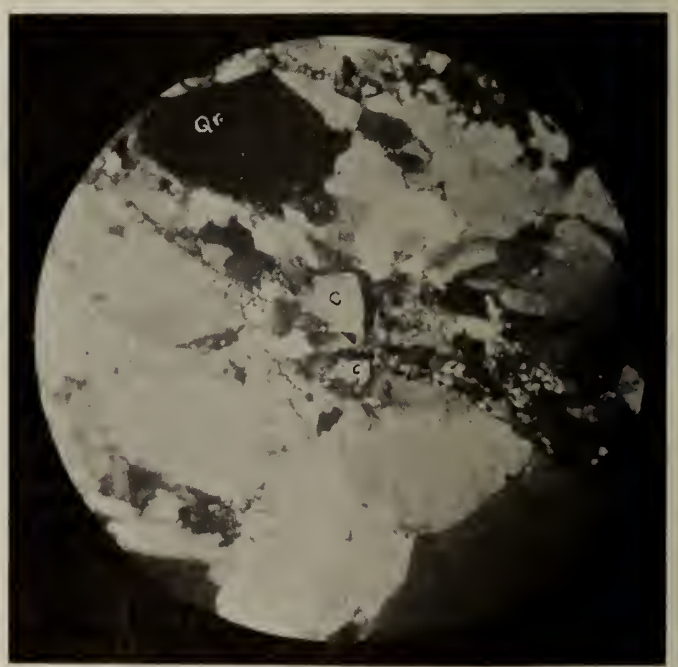
Photomicrograph No. 6, shows pyrite coating over calcite. Then again photomicrograph No. 1 shows pyrite within the quartz, and gold within this pyrite. Photomicrograph No. 4, shows pyrite within the calcite, and No. 7, shows what appears primary pyrite in the "mineralized" porphyry from the 100 ft. level, west

No. 5 x200

drift, Tough-Oakes Mine. In this photomicrograph is seen a large plagioclase phenocryst of the soda-lime variety, probably albite, whose outline is interrupted by the growth of the pyrite crystals.

Photomicrograph No. 7, shows both orthoclase and plagioclase phenocrysts.

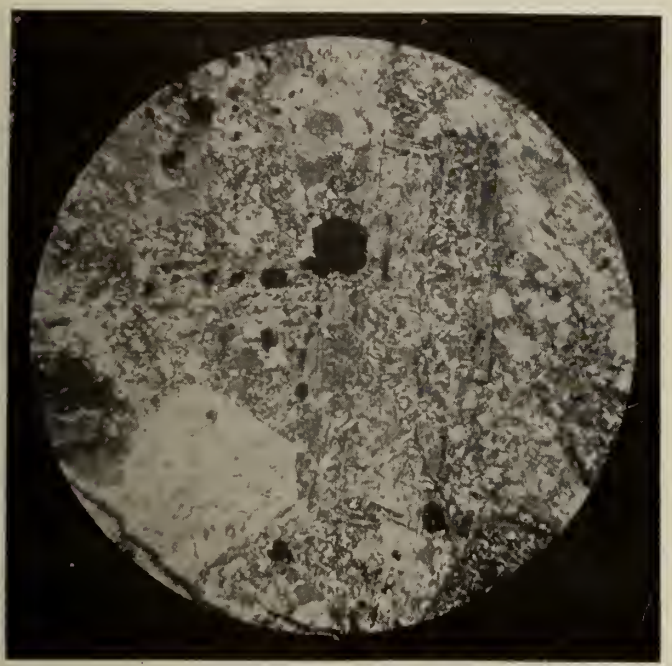
Photomicrograph No. 8, from a thin section from a rock specimen from the 100 ft. level, west drift, Tough-Oakes, exhibits several orthoclase phenocrysts together with acid plagioclases. The whole is very much de-



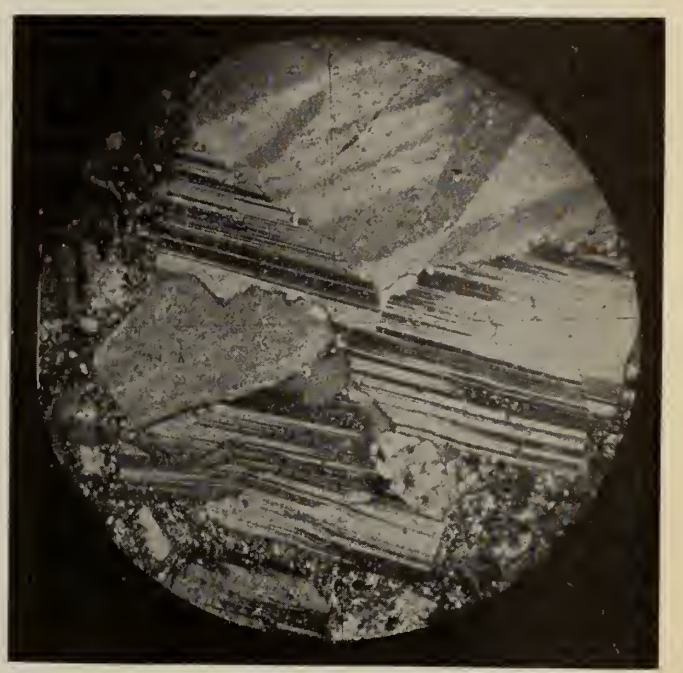
Gold Ore, Kirkland Lake No. 6 x42

composed, showing calcite, chlorite, saussurite and sericite as secondary minerals.

Photomicrograph No. 9, from porphyry exposed at the No. 9 vein of the Burnside, 25 ft. level, gives evidence of movements within the porphyry after the



No. 7 x42



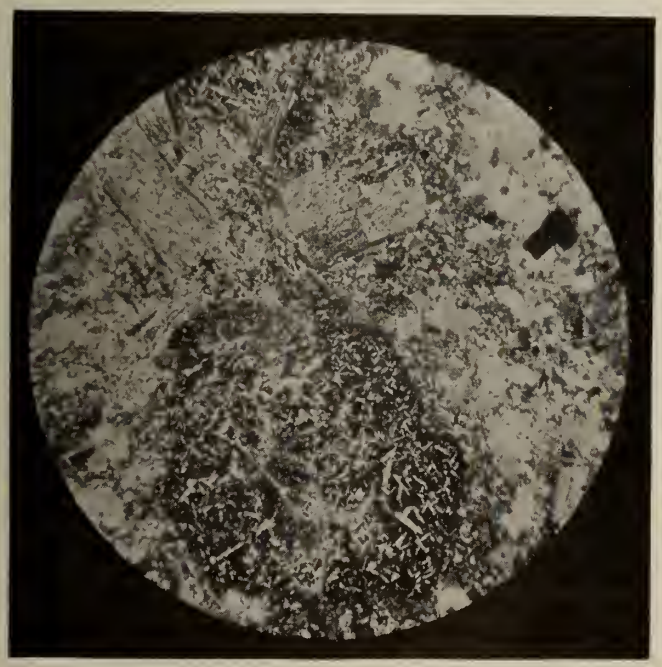
No. 9 x42

feldspar phenocrysts had formed, and before the magma as a whole had crystallized, as the crushing and fracturing is confined to the feldspar phenocrysts.*

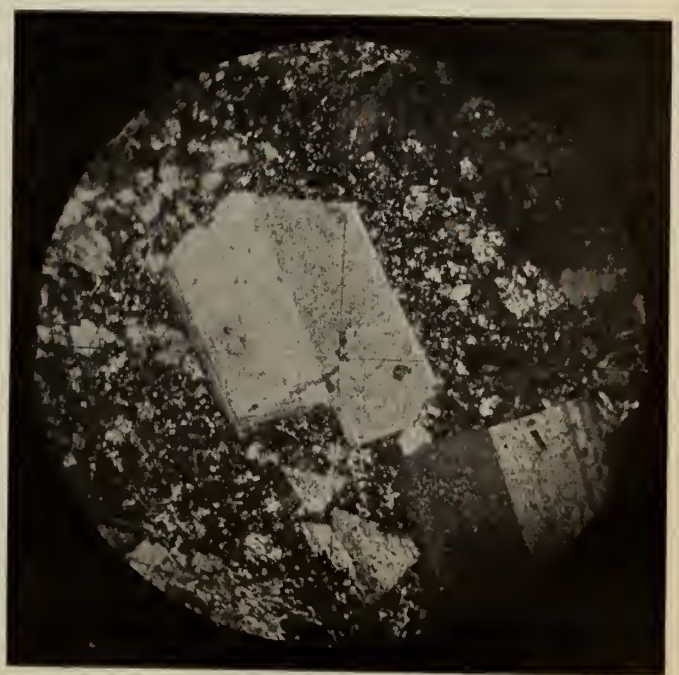
Both orthoclase and plagioclase appear in this section as well as in photomicrograph No. 10, taken from the same occurrence as photomicrograph No. 9, which shows evidences of crushing also. Both sections show abundant decomposition products in the ground mass, but the feldspars are comparatively fresh as compared with photomicrographs Nos. 7 and 8.

Wall Rocks, Kirkland Lake

Photomicrograph No. 11, displays a texture somewhat different from the usual texture of the porphyritic rocks of the district. This specimen was taken from a dike about one inch wide, encountered in a cross-cut through the sedimentaries on the Burnside property, at the 90 ft. level. The hand specimen presents an aphanitic texture, and greenish color, the color being due to the abundance of secondary minerals, principally chlorite and calcite. The dike is younger than the four-inch high grade ore deposit, found in the sedimentaries in the cross-cut, and it is younger than the porphyry, for it cuts both the ore deposit and the equally narrow bands of the reddish dense felsitic facies of the porphyry, lying on both the hanging and the footwall of the deposit. The photomicro-



No. 8 x42



No. 10 x42

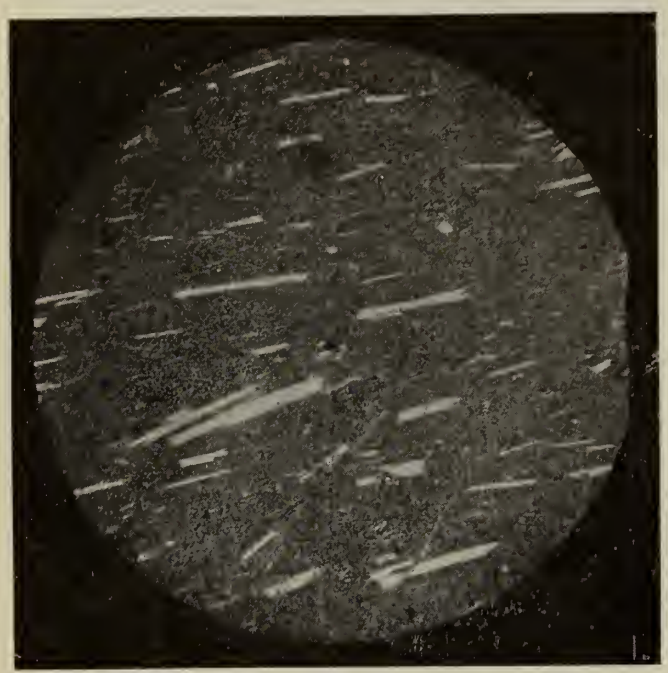
graph shows the typical parallel arrangement of the flow structure. The lath shaped feldspar crystallites

*—"Ore Deposits of Kirkland Lake District," by Chas. Spearman, Ibid, Oct. 1, 1913, p. 601, under "Deposits Within the Porphyry."

are highly altered, so that the species cannot be definitely determined. The ground mass shows a more or less isotropic residue.

Conclusions From Observations.

Every indication points to the conclusion that the gold and the tellurides were the first of the metallics to find a place in the ore deposits. They are very closely associated and bear evidence of contemporaneous origin. Pyrite, appearing at several stages in



No. 11 x42

the history of the deposits, had its initial introduction immediately after the gold and tellurides. Frequently the gold and tellurides are found encased in pyrite crystals (Photo No. 1). This is rather a departure from the usual order of occurrence as usually the gold deposition is induced by the pyrite.† This is the case in the Porcupine District where gold is often found as a coating, on the faces of pyrite crystals.

Although very little native gold is found in actual contact with the pyrite in the Kirkland Lake District, it being nearly always found with the tellurides, or in isolated particles, yet it is a very interesting fact that wherever pyrite is found in the "impregnated zone," gold is found also, and "the smaller the pyrite crystals, the higher the assay." This rule holds good also for the type of deposit within the porphyry.

Next in succession comes pyrargyrite and molybdenite, so closely associated and bearing so similar relationship to the minerals already deposited that it is difficult to determine their respective order. In the sections examined pyrargyrite appeared to be more abundant than the molybdenite. Both being in a very fine state of division, the hand specimen is apt to be misleading, giving the whole the aspect of being impregnated with molybdenite. It was commonly supposed that molybdenite acted as a precipitant of the gold, and its presence therefore was invariably regarded with favor, but the order of succession above outlined does not bear out this supposition.

With subsequent shearing and fracturing of the deposit, due to strains caused by certain movements, quartz and sometimes calcite was later introduced into the many almost microscopic as well as the larger fractures.

Photomicrograph No. 6, shows what resembles pyrite replacing calcite. This occurs in a crushed zone, and calcite filled in the voids in the breccia. Evidently, later solutions carrying pyrite replaced the calcite, showing a still later introduction of pyrite. No trace of gold or silver bearing minerals or molybdenite were found associated with this introduction. Again calcite and pyrite appear together (Photo No. 4) and pyrite appears as a primary mineral in the porphyry (Photo No. 7).

There are many indications that certain post-Temiskaming porphyry intrusives are genetically related to the ore deposits as outlined previously.*

There appears substantial proof that there are at least, three different ages of porphyry in the district. On the Burnside property a dense porphyritic intrusive with feldspar crystallites (Photo No. 11) cuts the chilled felsitic facies of the reddish porphyry. This shows clearly two ages, both post-Temiskaming. Then again many of the pebbles in the uptilted Temiskaming conglomerate are typical feldspar porphyry pebbles, identical with pre-Temiskaming feldspar porphyries exposed in the Kirkland Lake District.

Mr. Tyrrell apparently assumes that the porphyries are all of the same age, and correlates them as pre-Temiskaming. He concludes that they, being separated from the Temiskaming series by an erosion unconformity, can have no genetic connection with the ore deposits within the sediments. In part he is correct. The pre-Temiskaming porphyry is not genetically related to the ore deposits, but he overlooks the fact that the post-Temiskaming porphyries are intruded into the Temiskaming series, and not faulted contacts.**

What relationship does he establish between the porphyry and the ore deposits within the porphyry? The older of the two post-Temiskaming porphyritic intrusives, from evidence gathered from the field, is genetically related to the ore deposits in the Temiskaming series as well as to those within the post-Temiskaming porphyry itself.‡

Several thin sections from the principal ore deposits of the Porcupine District, kindly loaned the writer by Mr. Tyrrell, show a feldspar porphyry which is identical with the Kirkland Lake acid porphyries. Some thin sections showed a few quartz phenocrysts, and on the whole the porphyry may be said to be slightly more acidic than the Kirkland Lake porphyry. Many of the feldspar phenocrysts show the resorption phenomenon in a marked degree, and some showed the flow structure and still others showed fracturing of the feldspar phenocrysts. All the sections examined displayed an abundance of the usual secondary decomposition products. It would be interesting to know whether or not this porphyry bears any genetic relation to the Porcupine ore deposits. The presence of acid porphyries in connection with gold deposits is widespread and worthy of note and opens a broad field for investigation.

†—T. A. Rickard, The Indicator Vein, Ballarat, Australia, T. A. I. M. E., Aug., 1900.
*—"Discussion of Ore Deposits and Geology of Kirkland Lake," by A. G. Burrows, Ibid, April 1, 1914, p. 235; also "Ore Deposits of Kirkland Lake District," by C. Spearman, Ibid, Oct. 1, 1913, p. 600.
**—"Occurrence of Gold in Northern Ontario," by J. B. Tyrrell, Nov. 20, 1913; Inst. Mining and Metallurgy.
‡—"Ore Deposits of Kirkland Lake District," by Chas. Spearman, Ibid, Oct. 1, 1913, pp. 599-601.

TREATMENT OF BRITISH COLUMBIA ZINC ORES

In August, 1905, a Commission was appointed "to make an investigation of the zinc resources of British Columbia and their commercial possibilities. That Commission consisted of Mr. Walter Renton Ingalls, of New York City with Mr. Philip Argall, of Denver, Colorado, and Mr. A. C. Garde, of Nelson, British Columbia, as his assistants. This investigation was undertaken by the Government of Canada, in response to petitions from the Associated Silver-Lead Mines of British Columbia, and the Associated Boards of Trade of Eastern British Columbia. The letter of instructions from Dr. Eugene Haanel, then Superintendent (now Director) of Mines for the Dominion, included the following:

"This examination is to cover:

"1st. Examination of the present development of the mines to determine approximately the tonnage of zinc ore immediately available, its occurrence and character and the future prospects, together with the cost of mining.

"2nd. Examination of the present methods of milling.

"3rd. Investigation of the adaptability of the ores to the new methods of concentration (magnetic, electrostatic, etc.).

"4th. Study of the conditions affecting marketing of the concentrate, including the question of smelting in the Province or elsewhere in Canada.

"5th. Investigation of the possibility of special utilization of the zinc ore of high silver content."

Dr. A. E. Barlow and Mr. Joseph Keele, of the Geological Survey of Canada, were detailed to investigate the undeveloped zinc ore deposits, and Provincial Gold Commissioners supplied information relative to zinc ore occurrences in their respective districts. The metallurgical investigation of the samples of ore collected were conducted by Mr. Henry E. Wood, of Denver, Colorado, under the supervision of Mr. Argall and in consultation with Mr. Ingalls.

The report of the Commission, contained in a volume of nearly 400 pages, was submitted to the Minister of the Interior for Canada toward the end of September, 1906. The following "brief summary of some of the more important points brought out in the report," was printed in the "Report of the Minister of Mines for British Columbia, 1906:"

Present Possible Zinc Output.

"**East Kootenay.**—The two mines working are essentially lead mines, although containing considerable zinc—one of them has more developed zinc ore than any other mine in British Columbia—but the character of the ore is such that zinc extraction is almost hopeless (p. 47 of Report).

"**Ainsworth Mining Division.**—Assuming Blue Bell ore to contain 15 per cent. zinc mined en masse, then, if mined and concentrated at rate of 200 tons of ore a day, it might produce 39 tons a day of 50 per cent. concentrates. All other mines in the division might produce 15 tons a day of 50 per cent. concentrates.

"**Slocan.**—Mr. Ingalls says 15,000 tons per annum of concentrates (45 to 50 tons a day) would be a liberal estimate for Slocan, and this could only be produced as a by-product from the lead mining (p. 41-47).

"**Coast.**—The zinc deposits of the Coast are still of unknown magnitude; they are, in fact, nothing but prospects (p. 56).

Possibilities and Cost of Zinc Smelting in B. C.

"The ore must be taken to the coal, as the consumption of coal is 2 tons to 1 of ore; hence the only places adapted for zinc smelting in British Columbia are Crowsnest or Coast (pp. 51 and 52). Ore or concentrate must contain more than 40 per cent. metallic zinc. 'It is difficult to see how zinc smelting could be profitably carried on in British Columbia with coal at Crow's Nest Pass Coal Co.'s price'—$2 a ton (p. 52).

" 'The prospect for zinc smelting on the Coast, at least by the standard method, is too remote to merit detailed consideration at the present time' (p. 56).

"The estimated cost of smelting in British Columbia, given by Ingalls, for the running expenses of a perfectly equipped and economically run modern zinc smelter—with no allowance for interest on investment or legitimate profit—with coal at $1.50 a ton, and skilled labor at $3 a day of 10 hours, is $15 a ton (p. 54).

"(If we substitute in this estimate the lowest prices at present available, namely: Coal at $2 to $2.25 a ton, and skilled labor at $3.25 to $3.50 for 8 hours, it will make the estimated costs of operation about $18.75 a ton of 50 per cent. concentrates). Mr. Ingalls further estimates the cost of marketing the spelter produced from 1 ton of zinc concentrates at $8.50, which makes his total estimate $23.50 a ton of concentrates (or, if corrected as above noted, $26.75 a ton).

"The Report further estimates the cost of shipping the same concentrates to Europe for treatment would be $25.03 a ton, from which it would appear that zinc smelting is not at present feasible in British Columbia.

Electric Smelting of Zinc Ores.

"'The following are the conclusions arrived at by the Commission as to electric smelting of zinc ores in British Columbia (pp. 132-133):

"(1) 'Electric smelting will never displace ordinary (fire) smelting, if it is necessary to generate the power from coal.

"(2) 'Electric smelting, may be, in the future economically conducted at places where very cheap hydro-electric power is available.' (By 'cheap' he means less than $15 per horse-power per annum. Nelson and Trail are now paying $45 per h.p.. (See p. 67).

"(3) 'Aside from the question of power, up to the present time, certain peculiar and serious metallurgical difficulties in electric smelting have not been satisfactorily overcome.'

" 'It is unlikely that electric smelting of zinc ores can ever be profitably carried on in the zinc-producing district of East and West Kootenay' (p. 133)."

INVESTIGATION OF PROCESSES FOR THE REDUCTION OF REFRACTORY ZINC ORES.

In the "Summary Report of the Mines Branch of the Canada Department of Mines" for 1910 (pp. 11-13), may be found a copy of a petition from the zinc producers of East and West Kootenay, B.C., addressed to the Dominion Minister of Mines, asking for an investigation of modern processes for the extraction of zinc from refractory ores. This petition reviewed the situ-

ation as exhibited by the "Report of the Zinc Commission" above quoted from; narrated briefly what had been done by the Canada Zinc Co., at Nelson B. C., in experimenting in the electric smelting of zinc ores; stated that monetary assistance was required to the extent of $20,000 to $25,000 to make certain changes in the company's plant, and to operate it. . . . "to complete the experiments and demonstrate the commercial practicability of smelting the zinc ores with electricity." A proposal was made "to divert $50,000 of the unearned portion of the lead bounty fund to be used to complete the experiments in smelting zinc ores by the electrothermic process," and eventually there was adopted the recommendation of Dr. Haanel, Director of Mines, that such an amount be placed at the disposal of the Mines Branch of the Department of Mines, to be employed:

"1st. For the investigation on a commercial scale of the processes above enumerated, namely, (1) the De Laval process, in operation at Trollhatten, Sweden; (2) the improved process of De Laval, plant for the demonstration of which was then being erected in England; (3) the Cote-Pierron process, recently invented in France; (4) the bisulphite process, plant for the demonstration of which on a commercial scale was then nearly completed in Wales—or of any other process.

"2nd. For the setting up and operating of an experimental plant at Nelson, B.C., to test that one of the processes reported upon, which promises commercial success in treating the zinc ores of British Columbia."

In June, 1910, Mr. W. R. Ingalls was authorized "to inaugurate and carry through an investigation for the discovery or development of a method for the economic treatment of the mixed zinc sulphide ores of Canada in the production of metallic zinc of a marketable zinc product." Dr. Haanel wrote to Mr. Ingalls:

"The following recommendations made by you regarding the conduct of the investigation are approved, and are to be adhered to:

"1st: That you devote personal attention to all schemes that may be presented to the office in the interest of the problem to be solved.

"2nd. That it is specially agreed, that no invention that may result from this investigation be patented in the Dominion of Canada, but that rights may be reserved as to other countries.

"3rd. That all possible work in connection with this investigation be done in Canada.

"4th. That such small-scale experiments as would be most conveniently done by you outside of Canada be permitted to be done in such place as you may direct."

Progress reports of Mr. Ingalls were printed in the "Summary Report" of the Mines Branch for 1911 (pp. 14-15) and 1912 (pp. 8-10), and references were made to the work done at McGill University laboratory in connection with this investigation in a paper presented by Mr. Ingalls at the 1912 annual meeting of the Canadian Mining Institute (see Transactions of C.M.I., Vol. XV., 1912, pp. 101-114). The Mines Branch "Summary Report" for 1913 has not yet been published, but the position to-day in connection with the investigations that have been going on since 1910 is indicated in the following account of an address given on April 18, last, at Nelson, British Columbia, by Mr. Ingalls, before the members of the local Board of Trade and others interested. As reported in the Nelson "Daily News," Mr. Ingalls said:

The problem of treating mixed ores containing more or less zinc has been one of the most baffling of metallurgical problems of the last 60 years or more, and it is one that has remained without general solution. Much progress has been made in mechanical separation and in simple zinc smelting, which have rendered profitable ores that only 10 years ago were not so. There remain many kinds of zinc ores which are still unprofitable, because of their remoteness from market, adverse conditions of production, or complex character and low grade, and, unfortunately, they are the kinds possessed by many mine owners, including some of those in Kootenay district. With regard to these, the problem is not simply how can they be treated, but how can they be rated profitably, which means the discovery of some process cheaper than any known to metallurgists to-day.

When the Canada Department of Mines commenced an investigation with the object of finding such a process, it was not with the idea that in electric smelting alone would a solution be found. First there was reviewed all recent work in the general metallurgical field that we learned of. Besides making our own studies we considered the processes that were offered by many inventors, but were unable to find anything that gave even reasonable promise. Without abandoning consideration of other matters, we turned our attention to electric smelting, which is a subject of unknown possibilities, attractive because unknown, and the surface indications of which looked good. We were of course aware that electric smelting had for a number of years actually been done in Sweden and Norway; but we were also aware that it had not been successful, neither metallurgically nor commercially. If reference be made to the "Report of the Commission on the Investigation of the Zinc Resources of British Columbia," published by the Department of Mines, in 1906, with which report I had much to do, it will be found that information relative to electrothermic smelting of zinc ore was included. We were aware also that many persons other than those mentioned in the report, in America as well as in Europe had experimented in electric smelting, but up to that time none had been successful. It was therefore a fair field for study.

About two years ago a summary of a report upon electric smelting in Sweden and Norway was published in some of the technical journals, and I was asked through the Department of Mines why the Scandinavian process could not be transplanted to British Columbia. Having in possession the full text of the report, including all the figures given, I stated that costs in British Columbia for electric power, labor and other things were from two and one-half to three times higher than corresponding costs in Sweden and Norway. Under these conditions electric smelting in British Columbia would be out of the question.

Since that time the production of electric spelter in Scandinavia has attained considerable proportions, amounting to some thousands of tons per annum. While this spelter is obtained partly from smelting zinc dross and zinc junk generally, some of it is the product of ore smelting. However, I may mention as a recent substantiation of my opinion relative to the suggested introduction of this process into British Columbia that the directors of the principal Scandinavian company engaged in electric zinc smelting reported officially last November that up to August, 1913, they had not been able to smelt at a profit; they were hopeful,

though, that improvements then being made would enable them to do so eventually.

What then is the chief difficulty with the Scandinavian process? Primarily it requires too much power, and among the reasons for the extravagant use of power is the inability to condense a sufficiently large proportion of the zinc directly as spelter. The blue powder obtained is chiefly zinc, but in a non-commercial form. In order to get spelter from it a resmelting is necessary, and this adds greatly to the cost of treating the ore. The blue powder difficulty has perplexed everyone of the score or two score of investigators on electric zinc-smelting, save perhaps one who failed for other reasons.

We set out to learn how the condensation of zinc as blue powder could be reduced, and how the need for electric power could be otherwise cut down. We had no idea that blue powder could be wholly avoided, inasmuch as it is produced to a considerable extent in the ordinary process of fire smelting, and we could not hope to do better than that. Theory indicated that we might in this respect attain similar results to those from fire smelting; also that the requirement of electric energy might be otherwise reduced and possibly sufficiently to render power consumption no great obstacle to profitable operation. With that difficulty overcome, there were the chances of smelting in a unit of relatively larger size with possible economy of labor, and some other advantages as compared with ordinary fire smelting. Then, too, there was a possibility that silver-lead, copper matte and spelter could be produced by one furnace in a single operation, and that a higher percentage of extraction of the zinc, and especially of the silver and lead, could be made than in ordinary smelting. Moreover, it might be that some kinds of ore that at present it is not possible to treat—and there are such ores—would be found amenable to electric smelting. I say that these were possibilities; there was sufficient justification for spending time and money in testing them. However, they were never in my mind anything but possibilities, and I have never held out hope that they would be realized. On the contrary, I have been distinctly sceptical and guarded in what I have stated publicly concerning our results. I have been confident that metallurgic success would be attained, but herein I distinguish between metallurgical and commercial, although, of course, broadly speaking, a metallurgical success is not a real success unless it also be a commercial success.

In our work in the laboratory at McGill University, Montreal, where we tested our theory, experimented with different types of furnaces, and learned the A, B, C of the art, we succeeded in assuring ourselves that the production of blue powder could be reduced to something like the proportions of those of ordinary smelting, and we had some hopeful indications of reduced power consumption. Then we came to Nelson to try things on a larger scale. When in the laboratory we graduated from a 20-lb. to a 200-lb. furnace we encountered a new line of practical troubles. When we came here and graduated to a 2,000-lb. furnace, again we encountered new troubles, but magnified.

As I observe operations from day to day I experience the whole gamut of emotions. Some days, when things are going well, I am inwardly carried away with visions of what may be accomplished; on other days I am chastened in spirit. The fact is, electric smelting is a process of extraordinary delicacy. I know of nothing else in metallurgy that is comparable in its requirements to this one. In most processes, if things be set right, they stay right, with ordinary attention, but in this process there are at least eight different controls, all closely correlated, but more or less independent, which may change from hour to hour, and even more quickly, and make things go badly. The ordinary process of zinc smelting is one of delicacy, but electric smelting is far more so—at least, as we know it yet. A friend of mine, himself an experienced zinc smelter, can see no future for electric smelting, for this reason alone. I am far from being as pessimistic as that, but I will say to you positively that I cannot see any commercial possibility in a one-ton electric zinc furnace, nor a battery of such furnaces, and when I think of a 10-ton furnace I am appalled. Just as we have experienced new and magnified troubles in going from a 20-lb. to a 200-lb. furnace, and from a 200-lb. to a 2,000-lb., so we shall do in going from a 2,000-lb. to 20,000-lb. furnace. Indeed, the lines and working of a 20,000-lb. furnace are quite beyond my conception and, I am sure, that of the staff engaged here.

We have not yet got our furnace here running to our satisfaction. We seem now to be able to keep it going, and we make some spelter and matte and lead. If the work be continued, I think it probable that before long the control of the variables would be learned and metallurgical success be pronounced. At the annual meeting of the Canadian Mining Institute, held in Montreal, Quebec, early in March, Mr. W. McA. Johnson, who has been working for ten years on electric smelting of zinc ores, presented a paper entitled "The Commercial Aspect of Electric Zinc-Lead Smelting," in which he described a run with a 1-ton furnace at Hartford, Connecticut, which was a metallurgical success to a considerable degree. I saw that furnace in operation during that run and at the time of my visit it was working smoothly and encouragingly. Mr. Johnson deserves very great credit for what he has accomplished. We have been working on similar lines, but he is a lap or two ahead of us. He has organized a company which will erect a 10-ton furnace at some place in the United States and make a commercial test. He expresses himself confidently as to the result. Our own experience has led me to be much less sanguine, as you will have gathered from what I have already stated.

As you know, the money appropriated for our work has nearly all been spent. If the work is to be continued here, more money must be provided for it. I am speaking to you now merely as a consulting engineer, telling you squarely what the situation is from the technical standpoint and expressing to you very frankly what my opinions are, and I have been duly authorized by the Deputy Minister of Mines and the Director of Mines to do this. Of course I cannot speak for the Dominion Government. It is my understanding that more money was promised if necessary, and that that is recognized at headquarters in Ottawa. But it is my duty only to advise, and I cannot advise a Government any less honestly that I could a private client. I think that in due course of time the work being done here would, if continued, be brought to reasonable metallurgical success. I am positive, though, that even so there could be no commercial success expected from a 1-ton unit nor an extension of 1-ton units. What it would cost to go on and develop an 8-ton or a 10-ton unit is beyond human capacity to estimate. Those who promote such pioneering devel-

opments usually do so with the idea that when the money first provided is gone they will get more. In this case, although I will not venture to make an estimate or even a guess, I foresee that a great deal of money would ultimately be required. Now, an additional and large expenditure may be worth while, but when we see others, who are farther ahead than we are, about to do the same thing—and I can say from my own knowledge that their intentions are serious, and that their financing, if not adequate, is at least considerable; also, in view of the great uncertainty of the outcome any way, I am of opinion that it will be wisest to await that outcome, which will not be long delayed, and let it then be decided whether or not any more money ought to be spent here in doing similar work. You will not be any worse off, save in a little loss of time and perhaps not even in that, and you may save a lot of money. This is my advice to the Department of Mines and to you.

Production of zinc in British Columbia for five years—1909-1913:

	Lb.
In 1909 (approx.)	8,600,000
In 1910	2,634,544
In 1911	4,184,192
In 1912	5,358,280
In 1913	6,608,088
Total for five years	27,385,104

Note.—Forest fires in the summer of 1910 caused destruction of Whitewater concentrating plant and several miles of Kaslo & Sloean Railway, and resulted in cessation of production from Whitewater and Lucky Jim mines. The latter, two years later, resumed production in a small way. The chief producers of zinc last year were the Standard (with more than one-half of the total output), Rambler-Cariboo, Van-Roi, Lucky Jim, and, in much smaller degree, the Surprise and Noble Five. All the mines mentioned are situated in Sloean district. Two others—the Slocan Star and Hewitt-Lorna Doone—are expected to be added to the list this year.

Nelson Board of Trade Supports Proposal of Grant for Establishment of Demonstration Plant at Trail.

Nelson, B. C., May 6.—

"That this board favor and support the proposal that a grant be made by the Dominion Government to the Johnson Electrie Smelting, Incorporated, of $25,000 on completion by them of a demonstration plant of 10-ton capacity in West Kootenay ready for operation, and a second government grant of $25,000 upon a successful commercial demonstration of the operation of same by a continuous 30-day run under the oversight and to the satisfaction of the representative of the government," was the substance of a resolution unanimously passed at a special meeting of the board of trade last night after a lengthy discussion of two proposals made by the Johnson Electric Smelting, Incorporated, for the establishment of a commercial demonstration plant in this district with the possibility of there being ultimately established in the district a commercial smelter of sufficient capacity to handle the zinc ore output of this district.

Immediately on their return from Trail last night the Johnson party, composed of Byron E. Eldred, W. MeA. Johnson, Dr. James Struthers and Dr. Barlow, attended the meeting and Mr. Eldred informed the gathering that after a long discussion of the process and their proposals with the Trail Smelter people that the promise had been made to them that they would be allowed to use a portion of the Trail smelter site for the erection of their demonstration plant, that they would be furnished with suitable ore up to 2,000 tons in quantity at the exact cost of mining, roasting and delivering at their furnace. They had been treated very fairly indeed, said Mr. Eldred, and at the present time he said that he could see no place that would be better for their demonstration than Trail. They would save considerable by going there both in the matter of obtaining roasted ore and power. Part of the equipment of the local government experimental plant could be used by them at their proposed plant at Trail. He also stated that they had a great many offers from other sections of the continent to encourage them to locate their plant, but he felt that they were bound to stick with one proposition and not jump before the completion of negotiations for better or for worse.

The members of the party will leave to-night for Victoria, where they will meet Sir Richard McBride on the recommendation of R. F. Green, M. P., for Kootenay, with whom they were in toueh during their stay at Ottawa.

During the evening votes of thanks were tendered to the members of the Johnson party for their prompt response to the invitation from the board of trade and their businesslike manner of dealing with the board since their arrival here, and to George C. Maekenzie and E. Dedolph for the work whieh they had carried on at the government experimental smelter while it was in operation recently. Suitable replies were made by Mr. Eldred for the Johnson party and by Mr. Mackenzie.

The proposition of the Johnson people reeommended by the committee provided that they should eonstruct the demonstration plant at an approximate cost of $75,000, being guaranteed the sum of $25,000 when ready to blow in the plant and an additional prize of 25,000 being guaranteed on completion of a 30-day run eompleted to the satisfaction of government experts who would be appointed to watch the test. They would require that the duties on certain machinery that they required be rebated, and they would underwrite the whole smelter.

George C. Mackenzie, who had in eharge, on behalf of the Dominion Government, the experiments just coneluded in the local smelter, informed the meeting that a shipment of 40 tons of zinc ore from this district was to be sent to the smelter now operated by the Johnson people at Hartford at the expense of the Dominion Government, and a resolution passed at the meeting asked the Dominion Government if possible to send Dr. Stansfield, professor of metallurgy at McGill University, Montreal, to watch the trial there and that E. Dedolph, who has been conducting the experiment here for the government, be sent to assist Dr. Stansfield in his work.—Nelson Daily News.

THE MINING SOCIETY OF NOVA SCOTIA

By F. H. Sexton.

It is a pleasure to greet the members of The Mining Society of Nova Scotia at its twenty-second annual meeting, and the distinguished visitors from outside the province. We have the honor of being the oldest mining society in the Dominion, started as the Gold Miners' Association in 1884, and re-organized into The Mining Society of Nova Scotia in 1892. For four years we were united with the Federal Canadian Mining Institute, but it was not a happy or profitable alliance for Nova Scotia on the terms under which the federation was operated, so that we have pursued a separate existence since 1898.

The development of our little association on independent lines is in keeping with our position and tradition. Nova Scotia is more or less isolated geographically, and in other ways from the rest of Canada. No other province has as large a proportion of its population engaged in the fisheries. With the exception of a little coal and iron mining in New Brunswick, there is no mining industry of any great importance in the great stretch of area between Nova Scotia and Western Quebec. Our province has made great sacrifices in revenue and in hardy intelligent men to develop the great Northwest without yet receiving an adequate return in subsidies or land. The dominant labor organization of coal miners is a provincial organization. After a protracted and spirited struggle with the General Mining Association of London, the Government of Nova Scotia secured the titles to their mineral deposits and have reserved them for the benefit of all its people ever since. Aside from tariffs and bounties, the mining population of this province is not deeply interested in federal mining legislation. Without enumerating other instances, I believe I am within the facts in saying that most of our interests, our quality of life, manners, customs and institutions, are strongly provincial. Insular and narrow we may be, but we possess strength and vitality from our very limitations. It is idle to suppose that the present condition of our sentiments, actions, or ideals will materially alter within any short period of time.

The Mining Society of Nova Scotia has enjoyed a long and honorable career, and has rendered valuable service time and again to the mining fraternity which it represented, and to the province.

In its early days when gold mining was booming, its activities were most closely associated with that branch of the industry. Concurrent with the rapid development of the coal mining industry, a large number of eminent engineers in this field became identified with the society, and all worked together with a will for the good of the mining industry of this province. Many of the good features of our mining legislation, stand to the credit of this society. Under the energetic leadership of our former President, Mr. A. A. Hayward, and the efforts of Mr. Alexander McNeil, we were chiefly instrumental in bringing home the importance of technical education to the members of our Government prior to the establishment of a comprehensive system of industrial training in 1907. We have been active in securing funds for the perpetuation of the memory of the late Hugh Fletcher, among those who will not have known him well enough to cherish the remembrance of his rare personality, high ideals, and professional ability. These things and more can be adduced, but I hesitate lest we stifle our customary modesty in self-adulation.

With the recent temporary decline in the gold-mining industry, and the rapid expansion in coal production, it became evident to those who had the well-being of our society closest to heart, that we should have our headquarters in Sydney, while our quarters in Halifax should still be maintained. In order that this end should be accomplished, the council appealed to the large steel and coal companies to assist the project financially. A favorable response came immediately from the interested corporations, and to-day we are proud to state that we possess comfortable and attractive rooms in a central location in the Iron City, where we have placed a technical library replete with modern books on geology, metallurgy, and mining, the transactions of all the important mining associations all over the world, and the leading mining and metallurgical magazines. We have secured the services of Mr. E. C. Hanrahan as Secretary. His competency to fill this position has been demonstrated by his activities in a similar capacity in many other associations. Besides these provisions, we still retain our quarters in Halifax, and the indefatigable services of our Associate-Secretary, Mr. E. A. Saunders. In recognition of our expansion in effort, the Provincial Government has assurred us of an increase in its annual subsidy.

By these changes in organization and policy, we have added a large number of members to our society, most of whom could not have participated personally in the activities and good-fellowship of our association. We extend to these members of the metallurgical and coal mining fraternity our hearty welcome.

Recently there has been proposed some merger, affiliation, federation, or some other form of union between our society and the Canadian Mining Institute. There may be some members of the latter association who think that we should give up our organization and become a branch of their institution. I believe, however, it is the sentiment of a majority of our members who believe that we should not cast away our identity, and who think we can serve the best interests of the mining industry in this province, by retaining our name and individuality. There are many ways, however, in which our society could be benefited by becoming affiliated with the Canadian Mining Institute. There must be some plan by which the two societies could unite their efforts with greater effectiveness, and make the Institute a truly national organization. It would be a benefit in many ways if the members of the Nova Scotia Mining Society could be admitted to the privileges of membership in the Canadian Mining Institute, to receive their transactions, and to enlarge their scope of interest and action in co-operative goodwill with the mining fraternity of the other provinces. We declare ourselves narrow and prejudiced if we do not earnestly strive to consummate such a desirable end, and we show a small degree of intelligence if we cannot evolve some working plan of united effort which we may adopt without loss of individuality and provincial prestige.

(Extracts from the Presidential Address, April 15, 1914.)

LA ROSE CONSOLIDATED MINES.

In his report for the year 1913, Mr. R. B. Watson, general manager, gives the following information concerning operations at the La Rose, Lawson, Princess, Fisher-Eplett and other properties:

The production in silver ounces at the La Rose Mine in 1913 fell below the production at the Princess and also below the Lawson. Nothing of much importance was discovered on the parent claim during the year; several small stringers in the vicinity of No. 3 vein and a vein coming in from the Right-of-Way furnished most of the new ore. Considerable exploration was done in the bottom of the mine. A crosscut at a depth of 500 ft. below the collar of the main shaft, was run to the fault and 130 ft. of drifting was done. This work developed a large calcite vein along the fault which, however, carried only a small amount of silver. An incline shaft was then sunk on the fault for a distance of 233 feet below the 500 ft. level. Near the bottom, at a depth of 215 ft. drifts were run both ways for a combined distance of 80 ft. The exploration on this large calcite vein in the fault, while very promising at times, did not produce any pay ore, so work on and below the 500 ft. level was discontinued. Exploration is now centred on the 380 ft. level which is in the conglomerate, just above the Keewatin contact; cross-cuts are being driven in three directions on this level. The high grade ore left in the La Rose claim is estimated at 417,000 oz. Most of this is in No. 1 vein, near the surface. The claim has been well prospected underground and unless the exploration work on the 380 ft. level shows favorable results, the outlook at this property is not promising.

Although the Lawson showed a reserve of only 148,000 oz. a year ago, the production during the year amounted to 708,000 oz., and there remains a reserve of 125,000 oz. This result was due to the finding of several small ore bodies in the main vein to the west of No. 8 shaft. These ore shoots have all been stoped and there is very little in sight at present, except the broken ore in the stopes. Recently, a new vein was found in a cross-cut on the 188 ft. level, near the southern boundary of the claim. The vein is several inches wide, and while not high grade, carries some silver and gives promise of producing ore of value above this level. No. 8 shaft has been sunk to the 400 ft. level, and the main vein will be explored at this depth.

The Princess made a splendid record in 1913, having produced 909,000 oz. of silver, not taking into account the concentrating ore. More development work was done on this claim than on any others, and resulted in finding veins No. 10, No. 11 and No. 12. A winze was sunk on No. 7 vein from the third or 185 ft. level, down to the Keewatin contact, and the fourth level was driven at a depth of 225 ft. Some drifting was done on the Cobalt Lake fault on the third level, but no more favorable results were obtained here than at the La Rose. The balance of the main vein was stoped and hoisted, during the year; the only ore now in reserve in No. 12 vein. This vein was cut on the 132 ft. level; the ore shoot is 120 ft. long, and will probably go to the surface; there is an inch to an inch and a half of high grade ore, and a good width of mill rock. The Princess claim contains but 17 acres, and has been well prospected above the contact.

At the Fisher-Eplett work was carried on actively throughout the year. The shaft was sunk to the 300 ft. level, where 696 ft. of drifts and 561 ft. of cross-cuts were driven, without finding any ore of commercial value. A large flow of water has delayed operations somewhat, but the situation is improving. There still remains some promising territory to be developed from this shaft, and work will be continued.

Some cross-cutting was done on the Violet, without success. No further work was started on the La Rose Extension or on the University. The latter claim will be explored this year from the Lawson workings.

Mr. Watson gives the following summary of results obtained in 1913: The results in 1913 were much better than we had reason to expect a year ago. Over 2,636,000 oz. of silver were produced at a total cost of 22.8 cents per oz., leaving a profit of 36.52 cents per oz. on the shipments. The cost of production was 3.13 cents per oz. less than in 1912, but the price received for silver was 2.34 cents less. The market for these ores was poor during part of the year, and is still restricted on the lower grade products. The marketing charges have risen for this reason from 9.43 per cent to 10.42 per cent of the gross value. The net profit was $955.418.27; this is 61.38 per cent of the gross value of the ore. The concentrating ore on the dumps is about the same in amount as last year, but the high grade ore in reserve has been decreased by half. The chances of finding new high grade veins become less each year as the properties are more fully developed. Dividends declared for the period amount to $931,000. The net current surplus was increased to $1,528,776.94, made up of—cash and call loans $1,677,330.68; Supplies, ore on hand and at smelters $253,407.78, less dividend and accounts payable $401,961.52.

THE CONSTRUCTION OF CAGES.

The following amendment to the Mining Act of Ontario was introduced into the Legislature during the session of 1914 by Hon. Mr. Heart, Minister of Lands, Forests and Mines:

(1) Section 164 of the said Act is amended by adding as Rule 32a the following:

32a. All cages or skips used for lowering or raising men shall be constructed as follows:

(a) The hood shall be made of steel plate not less than three-sixteenths of an inch in thickness;

(b) The cage shall be provided with sheet iron or steel side casing not less than one-eighth of an inch in thickness, or with a netting composed of wire not less than one-eighth of an inch in diameter, and with doors made of suitable material;

(c) The doors shall extend at least five feet above the bottom of the cage, and shall be closed when lowering or hoisting men;

(d) The cage shall have overhead bars so arranged as to give every man an easy and secure handhold;

(e) The safety appliances shall be of sufficient strength to hold the cage or skip with its maximum load at any point in the shaft;

(f) The cage shall not have chairs attached thereto which are operated by a lever through or from the floor.

(2) This section shall not come into force until the 1st day of January, 1915.

During March the Le Roi No. 2, Ltd., shipped from its its Josie group of mines at Rossland, B.C., 1,480 tons of ore and 143 tons of concentrate. The month's receipts from the smeltery were $23,846; total expenditure was $18,300. Corresponding figures for January were: Total receipts, $31,662; expenditure, $20,400. February: Receipts, $9,977 (hoisting plant not running during one week, having been under repair); expenditure, $17,170.

IRON ORE DEPOSITS, BATHURST MINES, NEW BRUNSWICK*

By G. A. Young.

The iron ore deposits of Bathurst Mines occur in three main bodies or groups of bodies, the longer axes of which, at the surface run about north and south. These deposits occur within a limited area on the northern bank of Nipisiguit river and in the vicinity of Austin brook a south-easterly flowing tributary of the main river. One of the groups of iron ore bodies known as No. 2 deposit, outcrops on the northeast side of Austin brook valley and extends northward for at least 1,200 feet (360 m.). Another ore body, known as No. 1 deposit, outcrops on the southwest side of Austin brook valley about 900 feet (275 m.) west of No. 2 deposit and extends southerly for several thousand feet. The third group of ore bodies known as No. 3 deposit, lies nearly due north of No. 1 body at a distance of about 800 yards (730 m.).

In the immediate neighborhood of the ore bodies all the rocks are of igneous origin and belong to three main types, namely, quartz-free porphyry, quartz porphyry and diabase. The rocks in the district are largely covered by drift and therefore the relationship existing between the different rock varieties has not been established, but it is assumed that the quartz-free porphyry and the quartz porphyry are closely related in origin and age, and that the diabase occurs in dike or sill-like bodies cutting the porphyries.

The quartz-free porphyry outcrops in the eastern and southwestern portion of the area; the quartz porphyry forms the central portion of the area; and the diabase occurs in the western portion. No. 2 deposit lies within and just along the boundary between the area of quartz-free porphyry on the east and the central zone of quartz porphyry; No. 1 and No. 3 deposits occur along the western margin of the zone of quartz porphyry near the area occupied jointly by diabase and quartz-free porphyry.

The ore has generally a prominent slaty cleavage, is fine grained, and is composed largely of finely granular magnetite with a variable amount of hematite. Slight variations in grain are visible along regularly alternating bands. The banding varies in degree from microscopic to very broadly developed, being indicated where coarse by the occurrence of various impurities distributed along bands. The ore has a general black colour, tinged greyish from the presence of minute grains of quartz and feldspar which in some bands are finely and uniformly disseminated, while in other cases they occur in lines, narrow streaks and lenticular areas. Considerable pyrite is present and tends to occur in large and small, elongated, lenticular aggregates. Quartz is relatively abundant occurring in veins and stringers. A large number of analyses indicate that the iron content of the ore ranges from 39.6 per cent. to 58.7 per cent; sulphur from 0.009 per cent. to 0.27 per cent.; and, phosphorus from 0.385 per cent. to 1.222 per cent.

Examined in thin sections under the microscope, the ore is seen to be composed of minute, rapidly alternating bands of nearly pure iron ore, or of iron ore with considerable finely granular quartz and feldspar; and other bands of nearly pure quartz, with varying proportions of feldspar, iron ore, etc.

In the case of No. 2 body, a portion of its southern end, and of the east and west walls is visible. The greatest width of the body where stripped, is a little over 40 feet (12 m.). The containing walls are sharply defined, and the body appears to dip to the west at angles varying between 60° and 80°. The ore is banded and some quartz is present in comparatively large, irregular veins. Little or no pyrite is to be seen except immediately along the walls.

On the hanging wall side, at a distance of about 150 feet (45 m.) from the ore, ordinary schistose quartz porphyry crowded with phenocrysts of quartz and feldspar is visible. At exposures intermediate between this and the ore body, the rock gradually assumes a more schistose habit. On the foot-wall side an analogous set of phenomena is visible, but the rock there appears to be a quartz-free porphyry.

The southern termination of the ore body has been laid bare. The mass of ore ends in a number of angular, finger-like projections extending a few feet into the country rock and associated with considerable quartz.

In the case of No. 1 deposit, the foot-wall is exposed for a short distance. The rock, probably a much altered, schistose quartz porphyry, is very heavily charged with pyrite. It has a pronounced schistose parting along which occur seams and veins of quartz. The boundary of the ore body is remarkably sharp. The ore seems to end abruptly along the plane corresponding to that of the slaty parting and banding in the ore and of the schistose parting in the wall rocks.

The ore bodies have the form of abruptly terminating beds or bands, with, in each case, a fairly constant thickness. The walls where seen, are always sharply defined and dip westward at angles varying from 45° to nearly 90°. In the case of No. 1 deposit the ore body at its outcrop at the northern end has a thickness of 105 ft. (32 m.). In a drill hole which intersected the body at a vertical depth of 410 feet (125 m.), the ore body had a thickness of 65 feet (19.8 m.). As indicated by the results obtained from a magnetometric survey, the ore body has a length of about 2,000 feet (610 m.).

It is believed, for the following reasons, that the ore bodies have formed through the partial replacement of schistose quartz porphyry by iron ore, along sharply defined zones.

The prominent banding of the ore, sometimes on a coarse scale, sometimes microscopic in its fineness, is, when seen in thin sections under the microscope, very regular, and gives the impression of being an original structure, not a secondary one imparted in some way to the ore after its formation.

The parallelism of the banding of the ore (seemingly an original structure) and its attendant slaty cleavage, with the walls of the ore bodies and with the planes of schistosity in the neighboring rocks, forcibly suggests that the ore has replaced a schistose rock, and has partly preserved the original schistose structure.

The finely granular quartz present throughout the ore, as well as the less abundant granular feldspar, may readily be regarded as representing original constituents of the replaced, schistose rock, possibly sheared quartz porphyry. That the original rock was schistose is supported by the fact that in all cases where observa-

*Extracts from an article in Guide Book No. 1, published by the Geological Survey for the Twelfth International Geological Congress, August, 1913.

tions were possible the country rock, as it neared the ore bodies, was found to be progressively more schistose.

Under the above hypothesis, the occasional narrow bands of dark green schist seen in No. 1 body may represent a rock variety that more strongly resisted the replacing action of the ore bearing solutions. The apparently basic composition of these bands, and the occurrence of schistose diabase along the western walls of the ore body, suggest that they may represent dikes of diabase.

As regards the quartz veins, in the case of a thin section of ore charged with small reticulated and crenulated quartz veins, it was seen that the alternating microscopically fine lines and extremely narrow bands of quartz, quartz impregnated with iron ore, and nearly pure iron ore, conformed as nearly as possible to the intricate folding exhibited by the quartz veins. On the assumption that the ore and its structure are due to the replacement of schistose rock, the minutely corrugated forms exhibited by the ore represent a corrugated structure previously existing in the now replaced schist.

The appearance of the ore in thin section did not seem to indicate that the ore would fracture along the old corrugation planes, and so permit the formation of later quartz veins following similar crenulated courses, and, therefore, it is concluded that the veins did not originate after the formation of the ore.

The appearance in the thin sections of the bands or zones of quartz veins, and of the ore body as a whole, does not warrant any supposition that the quartz veins were bent after the formation of the ore.

It is true that the veins might have been formed contemporaneously with the ore, but, on the other hand, the puckering and bending of the veins in the ore are duplicated over a part of the exposures of country rock on the foot-wall of No. 1 body. This would indicate that the original rock had been twisted and bent, that quartz veins were introduced either before, during, or after the folding, and that after this the rock had been replaced by ore that still retains many indications of the original crenulations, as well as many or all of the quartz veins.

THE MINERALS SEPARATION DECISION.

The complete opinion of the United States Circuit Court of Appeals at San Francisco in the matter of James M. Hyde vs. Minerals Separation Ltd. and Minerals Separation American Syndicate Ltd., which decision was favorable to Hyde, covers 16 pages of typewritten matter. The bulk of this constitutes a review of the case tried in the lower court and references to other processes apparently similar or somewhat the same.

The finding itself, as rendered by Circuit Judge Gilbert, follows in full:

"We hold that to sustain the appellees' (Minerals Separation) patent would be to give to the owners thereof a monopoly of that which others had discovered. What they claim to be the new and useful feature of their invention, as stated by their counsel, is 'agitating the mixture to cause the oily coated mineral to form a froth.' As we have seen, that feature was clearly anticipated by the prior art, and when the elements of the appellees' claims are read one by one, it will be found that each step in their process is fully described in more than one of the patents of the prior art, with the single exception of the reduced quantity of oil which they use. The patentees of the appellees' patent made a valuable contribution to the art in discovering the smallest quantity of oil which would produce the desired result. In doing so they pursued the course which all skilful metallurgists would be expected to pursue. They made a series of experiments to determine how small a quantity of oil could be used successfully. They found, as all must find who use the oil flotation process, that certain oils are adapted to use with certain ores, and that a larger quantity of oil is necessary for one kind of an ore than for another. The appellees admit that for some ores they use four times as much oil as for others. Their discovery that a small fraction of 1 per cent of oil is sufficient to produce flotation of the metalliferous matter cannot, as we have seen, be made by itself or in combination, the subject of a patent.

"The appellees cannot take from others the right to use oil economically. This was evidently the ruling of the patent office on their application for the patent. One of their claims in the original application was 'the process of concentrating powdered ore, which consists in separating minerals from gangue by coating the minerals with oil in water containing a fraction of 1 per cent of oil on the ore, and recovering the oil coated minerals.' This was rejected in view of the Cattermole patent 'as expressing merely a difference of degree as to the proportion of oily matter employed.' Counsel for appellees admit that the claim was properly rejected for the reason that it leaves out the agitation and froth and says 'our invention is something else than the mere reduction of oil.' The decree (of lower court favoring Minerals Separation) is reversed and the case is remanded with instructions to dismiss the bill."

The lower court had sustained letters patent No 835,120 issued to Sulman, Picard and Ballot on Nov. 6, 1906, and assigned to the Minerals Separation Ltd. The appellant denied that these men were the first inventors of the process, or that there was any invention described in the patent.

The decision referred to the British patent to Haynes issued in 1860 and the United States patent issued to Everson in 1886. Miss Everson, the opinion reads, was the first to make the important discovery that the affinity of the oil for the metal was increased by the addition of an acid.—Boston News Bureau.

Notwithstanding that the Tyee Copper Co.'s smeltery and that of the Britannia Mining and Smelting Co., both situated on Vancouver island, only four or five hours' steaming distance from Vancouver, have been idle for years, an agitation is being worked up to try and secure the establishment of smelting works at that city.

The suitability of parts of Quesnel river, Cariboo district of British Columbia, for gold dredging is being claimed and an effort is being made to attract the attention of dredge operators to the possibilities of successful gold dredging in that part of the province.

Ore receipts at the Consolidated Mining and Smelting Company of Canada's smelting works at Trail, B.C., during the current year to April 23, totalled 111,250 tons, of which 87,040 tons came from the company's own mines in East and West Kootenay districts, and 24,210 tons was custom ore from various parts of the Province and the neighboring State of Washington.

COPPER LEACHING AND ELECTROLYTIC PRECIPITATION AT CHUQUICAMATA, CHILE*

By E. A. Cappelen Smith.

The Chuquicamata copper mine is located at Chuquicamata, a station on a branch of the Antofagasta and Bolivia Railroad, in the Province of Antofagasta, Chile, between 22 and 23 degrees south latitude. Chuquicamata is 165 miles by railroad from Antofagasta, and 82 miles in a straight line from the coast and lies at an altitude of 9,500 ft. above sea level.

The deposit has long been known as the atacamite deposit of Chile, and for many years past has been mined by the natives. As evidence of their operations we find in the old workings many stone utensils, hammers, etc.—and mummies.

The deposit is a brochantite mineral contained in the cleavages of the granodiorite, mixed in part with chalcanthite and to some extent with atacamite, and with a deposit of salt. A small amount of caliche containing nitrates is also present in the upper layers of the ore-body.

The so-called Llampera ore-body extends for a distance of approximately 8,000 ft. with an average width of about 500 ft. Throughout the whole length of the deposit numerous tunnels have been run and a very large quantity of ore has been left on the dumps from these tunnels. From the tunnels raises have been made almost to the surface, leaving in places a shell over the workings 8 to 12 in. thick. A few shafts have also been sunk in the ore deposits, the deepest one to a depth of 110 meters.

Acquisition and Development of the Property.

The property was acquired by Mr. Albert C. Burrage of Boston, who, in connection with the firm of Messrs. M. Guggenheim's Sons, formed the Chile Exploration Company, which company now owns the property.

The property has been explored by churn-hole drilling. The drilling has developed an ore-body in excess of 200,000,000 tons. Most of the drill holes, however, were stopped while the bottom of the hole was still in ore.

The general direction of the ore body is north and south. Lately a number of drill holes have been sunk at a considerable distance west of the Llampera, and after going through from 300 to 400 ft. of capping, chalcocite and chalcopyrite have been encountered, giving indications of a very materially increased tonnage over that reported up to date.

In the Llampera zone, of the 200,000,000 tons of ore so far developed, approximately two-thirds is brochantite and one-third sulphides. No change in the formation has been shown, even in the deepest drill holes, the ore still appearing to be in the cleavages of the granite. The lower drill holes show primary ore. From the amount of ore developed and indicated, it appears that the Chuquicamata mine is probably the largest copper deposit known to-day.

It was generally assumed that this large and well-known deposit of ore was atacamite, and as such could not be treated at a profit by any of the established methods; first, on account of the highly siliceous nature of the ore and the absence of sulphides and water, and, secondly, on account of the volatilization in smelting of the copper chloride.

It was demonstrated that the mineral was not atacamite (oxy-chloride) but brochantite (oxy-sulphate) and that mixed with the brochantite in the upper parts of the ore-body was a deposit of salt. The brochantite, being an oxy-sulphate of copper, is insoluble in water but very readily soluble in dilute sulphuric acid. It was, therefore, evident that the way to treat the brochantite ore-body would be by wet methods.

Design of Plant Now Building at Chuquicamata.

On account of the very large ore body already developed at Chuquicamata the first unit of the plant now building has been designed to treat about 10,000 tons of ore per day. The electrolytic refinery will have a capacity of about 335,000 pounds of copper per day.

The ore will be mined by steam shovels, practically no stripping being necessary. The ore will be transported to the mill, distant about 2½ miles from the mine, in standard American gauge railroad cars of 60 tons capacity each.

Arriving at the plant, the ore will first pass through gyratory crushers, thence through 48-in. Symons disc crushers, and finally through Garfield rolls until a product is obtained of about ¼ in. mesh. The ore will be carried on conveying belts from the crushing plant, after sampling, to the leaching vats. Each of the leaching vats has the following dimensions, 110 ft. wide, 160 ft. long and 16 ft. high. The leaching vats, six in number, will be placed end to end.

The belt delivering the ore from the crushing plant will be discharged into the leaching vats with the aid of an electric traveling bridge, spanning and traveling the entire length of the leaching tanks. The leached and washed residue will be removed from the leaching tanks by a 15-ton grab bucket traveling on an unloading bridge and, after sampling, will be delivered onto a conveying belt for disposal to the tailings dump.

The tanks are being built of heavily reinforced concrete, and will be lined with mastic asphalt 1½ in. thick. This tank lining has been developed by the Vulcanite Paving Company of Philadelphia, and consists of a specially refined Trinidad asphalt mixture, to which is added crushed quartz or granite.

In our experimental plant, where this lining has been in use for considerably more than a year, both in the leaching and electrolytic tanks, absolutely no difficulty has developed—not even a single leak. We have tested the material at a temperature of 50 deg. C. without finding any signs of softening, and as this is far beyond the range at which we intend to operate tests at higher temperatures have not been made, although the temperature limit, so far as softening is concerned, will probably lie somewhere between 50 deg. and 70 deg. C.

Tests have also been made to try the strength of this material from a physical standpoint, and in one case a 250-pound cathode was elevated about 5 ft. above the bottom of the tank and then dropped in such a way that one of the sharp corners of the cathode hit the bottom of the asphalt-lined tank. In this case a piece of the lining about ⅛ in. thick and

*A lecture delivered at the 25th General Meeting of the American Electrochemical Society, Columbia University, New York City, April 18 1914.

2 ft. in diameter was broken away, and as far as we could see the tank lining was just as good as ever.

The material has been tested in strong and weak acid solutions and found to be absolutely unattacked.

From the bottom of the leaching tanks the solution will be removed through eight 6-in. openings equally distributed over the tanks. A filter-bottom, consisting of two layers of 2-in. planks with a layer of cocoa-matting between, will be employed. This filter-bottom will be raised 4 in. above the bottom of the tank.

For the main solution circuits, 9-in. and 16-in. lead-lined iron pipe will be used. Open-boot horizontal centrifugal pumps, made of type-metal, will be used for pumping the solutions. The pumps will have a capacity of 550 cu. ft. per minute, elevating to a height of 60 ft.

In the leaching plant the cycle of operation will require approximately six days, of which one day will be occupied in filling the tank, two days in leaching, two days in washing and draining and one day in discharging.

The solutions will be conducted to the leaching tanks by gravity from nine solution-storage tanks placed above the leaching tanks. The dimensions of these solution-storage tanks are as follows:

Two tanks	12 ft. x 130 ft. x 150 ft.
Seven tanks	12 ft. x 70 ft. x 150 ft.

From the strong-solution tank the solution will flow by gravity through the dechlorinating plant, consisting of twenty-one 30-ft. long by 4-ft. inside diameter revolving steel drums lined with earthenware. These drums will be half full of shot copper. From these drums the solution, containing the cuprous chloride in suspension, will flow to seven Dorr thickeners made of concrete and lined with mastic asphalt. The clear solution overflowing will travel by gravity to the electrolytic refinery, while the thickened cuprous chloride, together with approximately 1 per cent. of the original solution, will go to filter presses.

The electrolytic refinery will consist of 510 electrolytic tanks of the following dimensions: 19 ft. long, 3 ft. 6 in. wide, 4 ft. 10 in. deep. They will be made of concrete, lined with mastic asphalt, and will be set through the floor, having inspection aisles underneath and a concrete working platform between the rows of tanks. The tank-house will be of concrete and steel construction.

Of the 510 tanks, 30 will be used for making cathode starting sheets, and the balance, 480 tanks, will be used for electrolytic deposition of the copper from solutions. The tanks will be arranged in five electrical circuits, with 96 tanks to a circuit, and will be divided into 30 solution circuits, the solution in each circuit flowing through 16 tanks placed in cascade.

The anodes, made of magnetite, will be 5 in. wide, 2 in. thick and 4 ft. long, with five to a bar. The cathodes will be 3 ft. wide by 4 ft. deep.

The spent electrolyte, containing about 1.5 per cent copper, will be pumped back to the storage tanks to be used for leaching subsequent charges of ore.

The cuprous chloride from the dechlorinating plant will be smelted and cast into shot copper for use in the dechlorinating drums.

The power plant will consist of a primary power station at the coast, using oil-fired Babcock & Wilcox boilers driving four steam turbines, connected to four 10,000 kw. alternating current generators. The current will be transmitted 85 miles at 100,000 volts to a sub-station located at the mill-site. The sub-station for the electrolytic refinery will consist of seven motor-generator sets, each of 2,500 kw. capacity.

THE WEIGHT OF RAND STAMPS.

According to the South African Mining Journal South Africa leads the world to-day in stamp milling practice. Here there are employed the heaviest gravity heads erected, and, excepting pneumatic and steam stamps, such as are, for instance, employed at the Dolcoath Tin Mine in Cornwall, and the copper mines of the Lake Superior region, the duty per head is the largest of any mining field in the world. Last year the duty per stamp per day along the Main Reef Series was 8.82 tons, as against 8.39 tons in 1912, 7.88 tons in 1911, 7.19 tons in 1910, 6.79 tons in 1909, and 6.27 tons in 1908.

"This rate of increase in tonnage milled per stamp in 24 hours is likely to be maintained this year, and it is anticipated that the duty for 1914 will work out at nine tons or over. Towards the end of this year the "State Mines" 50,000 tons per month equipment on the Modderfontein Government Areas will be completed, and at a somewhat later date the Modder Deep Levels reduction plant, which will consist of 60 stamps and 6 tube mills, and which will crush 30,000 tons per month, will come into operation. It is probable, too, that the Sub-Nigel will extend its crushing equipment in the near future. This mine is outside the Witwatersrand area, but as it comes under the control of one of the most progressive metallurgical administrations in the world, the subject of a possible extension to the Sub-Nigel mill certainly falls within the scope of this article. In the case of each of the mines mentioned in the foregoing, the stamps will be of "heavy pattern." The Rand's stamp duty has been increased, not alone by the use of coarse screening and the employment of tube mills, as auxiliary fine grinding machines, but by greatly increasing the falling weights of the stamps, that is by adding to the weights of stems, heads, tappets and shoes. Just to what degree extra falling weight has been responsible for the increase in duty, and to what extent coarse crushing in the mortar boxes and subsequent fine grinding in tubes have played their respective parts it is difficult to say; the subject is worthy of inquiry.

"In the middle nineties the duty of five tons per day was considered exceedingly good, and if we recollect rightly, the heaviest heads on the Witwatersrand at that time were the 40 stamps of the New Modderfontein, each of which had a falling weight of 1,250 lbs.

"There are in all erected on the Rand to-day 1,380 stamps of over 1,750 lb. weight, and of these between eleven and twelve hundred are at work. It seems clear that these weights are considerably greater than those of other gold mining fields, whilst the duties, too, are substantially higher. The world's record duty for gravitation stamps will be obtained by the Shamva Co., in the Abercorn district of Mashonaland, but it should be pointed out that these heads are of Nissen pattern, and are not of ordinary Californian type, such as this article is concerned with.

"The stamp weights referred to in the foregoing are substantially heavier than those recorded in respect of United States gold mines. Most of the installations in the United States are from 1,000 to 1,200 lb. per stamp. On the Mother Lode of California they vary from 850 to 1,250 lb., with an average, for 24 mills containing 1,090 stamps, of 1,000 lb. Heavier stamps, 1,400 lb., have been installed in the United States, and last year

1,500 lb. stamps were specified for the Commonwealth mill, Pearce, Ariz. We note an opinion recently expressed by a United States mining authority that on the Rand the weight of stamps appears to have reached a maximum. The accuracy of this view is open to question. Year after year the duty and the average weight of stamps operating along the Main Reef series increases. A tendency to ask for larger and larger tonnages from a given number of stamps is evident, in other words a disposition to intensify milling efficiency is to be observed. It is not unlikely that the deliberations of the Sunday Observance Commissioners will tend towards further intensification of efficiency. That is to say the falling weights of Rand stamps may be further increased and the duties correspondingly raised."

MODERN ROCK DRILLS

By P. B. McDonald.

It seems that a new rock drill is invented every week. The mine manager nowadays has as much trouble keeping track of the latest in rock drills as the average citizen has in automobiles. It used to be possible to classify drills by their mechanical principles, but there are too many principles, too intricately mixed, to allow one to remember them all. The most convenient classification is the use for which they are desired, sinking, drifting or stoping.

Sinking.

Shaft sinking is, at first thought, an insignificant part of mining, yet in many mines there is always sinking going on, in one form or another—deepening old shafts, starting new ones, winzes, etc. Usually the best miners are reserved for shaft sinking (probably because it costs several times as much as drifting), and short shifts are allowed, particularly in wet ground.

For sinking a drill must be adapted for "down-holes," practically vertical. The heavy, reciprocating drill mounted on tripod or bar, has always been popular. One man was accustomed to bail water with a can into the muddy hole where the drill-steel was pumping up and down, while the other manipulated the crank for feeding the drill ahead. Full length holes were favored, six ft. or more, on account of the bother in removing all the heavy paraphernalia when blasting. The tendency lately has been toward little one-man sinkers, on the order of a "plugger" drill, that is, unmounted and held in the hands. These sinkers are not reciprocating; but are of the "hammer" type. The drill steel is stationary and is hammered with a great number of comparatively light, quick blows. The same principle made "stoper" drills very popular.

At first, such drills had to be rotated by hand, but automatic rotation was introduced and is largely responsible for the type's popularity. As compared with a reciprocating drill, the feeding is accomplished merely by "pushing" by the miner, and not by a screw-feed regulated by a crank. Obviously, these light sinkers are easily removed at blasting time. There is therefore a tendency toward the European practice of shorter holes and more frequent blasting. Their chief advantage, however, is in the fact that about twice the number of drills can be used in a given space as with the tripod drill. Whenever used, these little sinkers are making records.

Drifting.

Drifting is still accomplished from a column or bar. There has been occasional talk of drifting with an unmounted drill, but only in exceptional cases has it succeeded. This statement, of course, does not apply to soft rock, such as the hematite on the Mesabi range in Minnesota, for which unmounted drills and power augers are already replacing the hand auger methods. One decided innovation in hard rock drifting is the application of the "hammer" principle in place of the reciprocating drill. There is at least one widely successful drill, which combines the hammer principle with a heavy, mounted, screw-fed type, and is particularly adapted to hard rock.

In drifting, more than in stoping or sinking, attention has to be directed to removing the rock cuttings which are liable to remain in the drill hole and cause trouble. In sinking it is easy to put water into a down-hole, while in stoping—meaning overhand stoping—the rock chippings fall down by gravity. But in drifting there are some holes of a slight upward inclination, not steep enough to cause the chippings to fall back and a little too steep to throw water up. Hence the success of the "water" drill, which forces a stream of water through the hollow drill-steel.

Of course, the most decided tendency in recent reciprocating drills has been the advent of light, one-man machines, with special light weight bar and column. This has been brought about by the demand for greater efficiency, inasmuch as one man, with a fast drilling, light machine can frequently do as much work as two men with a heavy drill.

Stoping.

The success of the "stoper" drill is an old story. Wherever "up-holes" are desired, as in over-hand stoping and in raising, the one-man, hammer type, air-feed drill is an acknowledged winner. It has revolutionized stoping the world over. There are a few districts where, for some reason, stoper drills never got a start; but it is usually for some exceptional reason or prejudice. The stoper has one big advantage—it is a one-man drill which is easy to run. Of course, the runner has to rotate it, by short arm swings, through a quarter circle, but it feeds itself—or rather the pressure of the air feeds it ahead; it requires no "rigging up." There are no nuts to loosen and changing steel is the simplest of operations. It is easy to drag around. Since it is used only for up-holes, the rock chippings fall back by gravity. Very often, the mine foreman will pick out from the force of miners some man who has a capacity for doing things unaided, and will keep him regularly at raise work with a stoper drill.

The total value of the metalliferous minerals produced in the Coast district of British Columbia is shown by official records to be increasing to an important extent. By five-year periods it has been as follows: For 1899-1903, $3,148,256; for 1904-1908, $4,264,525; for 1909-1913, $7,270,495.

A news item lately published in British Columbia is, as follows: The Kennicott Mines Co., operating the Bonanza copper mines in Alaska, controlled by the Morgan-Guggenheim syndicate, has declared and paid a $1,000,000 dividend. This brings the total distribution since 1910 up to $5,000,000.

The Canadian Pacific Railway Co. is stated to be applying for running rights over the Canadian Northern Railway from just east of Rocky Mountain House, where the lines of the two companies junction, west to the Brazeau coal mines, so that Red Deer, Alberta, expects to be by late next summer connected by both railways with large coal deposits.

LILLOOET DISTRICT, BRITISH COLUMBIA

The following are excerpts from an official report made to the Provincial Government by Mr. G. M. Downton, British Columbia land surveyor, on Lillooet district, the only town of importance in which is Lillooet, distant from the city of Vancouver, taking the route of the Pacific Great Eastern Railway, now being constructed, 163 miles.

The Pemberton section is looked upon by mining men who have a knowledge of the district as offering great possibilities in iron, copper and silver. The provision of transportation facilities will make accessible several properties hitherto unworkable. The number of "wildcats" which in years gone by have shaken the confidence of investors throughout the Province in Lillooet mining propositions, have done much toward hampering the development of the mining industry in this region. But, in the opinion of mining experts, the country opened up by the Pacific Great Eastern Railway in passing through from Green river to Seton lake and Lillooet is one of the most promising mining regions in British Columbia.

The railway follows the west side of Anderson lake close to the water throughout the entire length of the lake, a distance of about ten miles. Both McGillivray and Roaring Creeks flow into Anderson lake on the west side. There is a water power of considerable magnitude near the mouth of McGillivray creek, where this creek falls over a cliff about 100 ft. high, in a magnificent waterfall. A small amount of this power is utilized at a saw mill on the lake shore near the mouth of the creek. The country lying on both sides of McGillivray creek, from its headquarters to its mouth, is highly mineralized, and a large number of mineral claims have been staked and prospected, but owing to lack of transportation very little development work has been attempted.

At present the town of Lillooet is reached by way of Lytton or Ashcroft, both on the main line of the Canadian Pacific Railway, the former being 47 and the latter 63 miles distant. It has a daily mail service and a telegraph office, and has telephone communication with Lytton, Shot Portage and Bridge River. It has three churches, two good hotels, several well supplied stores and a population of about 300, which has been largely augmented recently by the floating population connected with railway construction. It is beautifully situated on an extensive bench above the Fraser river, with a south-easterly aspect, and is well protected from the northerly winds by a high mountain at the rear of the town. The climate is dry and invigorating, the heat in summer seldom excessive, and the winter comparatively mild. Snow seldom lies for any length of time in the winter, and the water supply is good. With the completion of the railway, Lillooet will be within seven hours' run of Vancouver. It is immediately surrounded by a country the possibilities of which have up to the present hardly been recognized, owing chiefly to the lack of markets and adequate means of communication.

The north fork of Bridge river, about 18 miles north of Lillooet, is reached by pack trail up the valley of the main Bridge river, which enters the Fraser river five miles north of Lillooet. As with many other parts of the district, lack of transportation facilities has seriously hampered development, for up to the present time the only means of access has been by pack trail; but late last autumn the Provincial Government commenced the construction of a wagon road into this valley, and will probably complete it before the end of 1914. There is a post office situated on Messrs. Birch and Duncan's ranch, about three miles above the junction of the north fork with the main Bridge river, with a monthly mail service. The name of this district is "Moha," an Indian name signifying "Junction of Waters." Placer mining has been carried on in a desultory manner for several years in this neighborhood, but as yet results have not justified extensive operations.

To Mr. Downton's notes may be added the information that lode mining has been done both on McGillivray creek and on Cadwallader creek, the latter being a tributary of the north fork of Bridge river, and that the 1910 Annual Report of the Minister of Mines for British Columbia contains an illustrated report on Lillooet district by Mr. Wm. Fleet Robertson, Provincial Mineralogist, which report is obtainable gratis on application to the Department of Mines, Victoria, B.C.

LE ROI NO. 2, LTD.

The thirteenth annual meeting of the shareholders in the Le Roi No. 2, Ltd., operating the Josie group of mines and a concentrating mill in Rossland camp, British Columbia, was held in London, England, on February 23 last. Lord Ernest Hamilton, chairman of the Board of Directors, presided.

The following is the greater part of the directors' report for the fiscal year:

Accounts.—The accounts show a balance of £1,598 4s. 2d. in favor of Profit and Loss, after writing off £21,650 3s. 5d. as depreciation in respect of development, machinery, buildings, etc., which, added to the balance brought forward from 1912, namely £26,924 10s. 9d., makes £28,522 14s. 11d. to be carried forward.

Production.—On reference to the mine manager's report, it will be seen that 40,575 tons of ore was mined, of which 19,032 tons was shipped to the smeltery, the average value per ton being $19.60, as against 18,257 tons of an average value of $20.10 per ton shipped during the previous year. From 16,530 tons of low grade ore there was produced 1,595 tons of concentrate, averaging $19.62 per ton. Mining costs worked out at $3.57 per ton and smelting charges at $6.07 per ton, making a total, after allowing for development and depreciation, of $12.48 per ton, as against $12.18 per ton for 1912.

Exploration.—A large amount of exploration work has been done during the period under review; the most important has been the development of the Rodney ore body on the 1,500 ft. level. Thanks to the courtesy of our neighbors, the Consolidated Mining and Smelting Company of Canada, we have been able to explore this ground from their workings. Moreover, satisfactory arrangements have recently been come to with them for the investigation and stoping in the future.

The importance of this ore body, which was foreshadowed by the chairman in his speech a year ago, has been amply confirmed. The work done has been more than paid for by the ore extracted in the course of development, and the winze now being sunk is revealing a width of 22 ft. of mineral of an average assay value of $16 a ton.

Exploration on the 600 ft. level on the Annie vein, west of what is known as the white dike, disclosed No. 37 ore body, which proved to be of great value, containing good gold and copper values. Some of the richest ore from the mine has been obtained here. The

vein has been traced to the 900 ft. level, but it was at that point unprofitable. The rich ore, however, has been proved to extend below the 700 ft. level, and it is not unreasonable to expect further discoveries in the neighborhood.

As regards the northern development, although nothing of a sensational character has yet been encountered, the diamond drill has revealed 2.5 ft. of well mineralized ore on the Monita claim. A drift is being run to explore this find, which may prove to be important, in view of the exceptionally fine ore body which, it is understood, the Consolidated Co. has in the adjoining ground. Altogether 4,633 ft. of drifting, raising and crosscutting has been done at a cost of $15.87 per ft., and 15,075 ft. of drilling at a cost in labor and material of $24,142, or $1.60 per ft.

Van-Roi Mining Co., Ltd.—The confident hopes expressed at the meeting last year in respect of this company (in which the Le Roi No. 2 holds a large interest), have unfortunately not been justified by results. At that date the ore exposed at all working points had greatly improved in grade, and it seemed reasonable to expect satisfactory and profitable returns as soon as adequate ventilation permitted stoping to be resumed. Subsequent work was, however, disappointing, the ore becoming poor in grade. Owing to the few points of attack available, this necessitated a fresh scheme of development and exploration, the benefit of which is only now beginning to be obtained.

At the Meeting.

At the meeting, the chairman stated that among the important improvements at the company's mines at Rossland during the fiscal year, was the proving of the existence of profitable ore on the 900 ft. level of the company's Josie mine, which is a zone heretofore looked upon as more or less unprofitable. The most important development had been on the 1,500 ft. level, which corresponds to the 1,650 ft. level of the adjoining Le Roi mine. There had been proved to occur at that depth an ore body about 22 ft. in width. By the courtesy of the Consolidated Mining and Smelting Co., which owns the Le Roi, the Le Roi No. 2 company had been permitted to explore on its 1,500 ft. level from the 1,650 ft. level of the Le Roi, but so far no ore had been stoped from these new workings. Arrangements have, however, just been completed with the Consolidated Co. that will allow of ore being extracted from this new region and sent out through the Le Roi workings. This new development opens up great possibilities for the future, not only as regards the value of this particular ore body, but because it offers facilities for further development at depth which may, and should, result in the discovery of other ore bodies on that level, and at greater depth.

Mr. Chas. H. Stewart, of Alex. Hill & Stewart, managers and consulting engineers for the Le Roi No. 2, Ltd., also gave the annual meeting information of much interest to shareholders in the company. He said that the production for the four months from the end of the last financial year had a value of $124,000, while working expenses had been $41,000, and development expenditure $42,500, leaving a net profit for that period of approximately $40,000. It was impossible to forecast the tonnage of ore reserves which would be opened on the deep ore body, for as yet they had only two dimensions of it—they knew its length and width, but had not yet explored its depth, except that a winze had been sunk in it 17 ft. It had the appearance of being a large, important and valuable ore body, and, occurring as it did at the deepest level yet reached in the company's property, it added to the chances of discovering other ore bodies in depth. A few years ago it was supposed that ore bodies in Rossland mines were of no value below the 500 or 700 ft. level, but recent experience in Rossland camp pointed to the recurrence of good value at greater depths. A year ago the Le Roi No. 2 company might have deepened its own shaft and crosscut to the ore body at the 1,500 ft. level at a cost of £5,000 or £6,000, but by not doing so, while they had lost in time, they had gained in cash, for arrangements had since been made under which they will be able to work that ore body through the shaft and other workings of the neighboring Le Roi mine.

With regard to the development of the northern part of the Le Roi No. 2 company's property, Mr. Stewart said that by boreholes and other explorations they had discovered the westward continuation of an important ore body, which had been successfully exploited in the adjacent War Eagle mine. It was not proved absolutely that it was the same ore body, but both they and their neighbors believed it to be the same. It was situated on the Monita claim, which the Le Roi No. 2 company acquired in the course of exchanges with the Consolidated Co. last year in connection with the elimination of extra-lateral rights. Another borehole had discovered what they believed to be the downward continuation of No. 1 vein; the value was good, but the width was very small; it must be left to further exploration to follow it and determine its worth. As to the No. 37 ore body—it contains ore of high copper value and a fair value in gold. It was the North Annie vein; it had been found on the 600 and 700 ft. levels, and was now being worked above the 900 ft. level, but they had not found it to exist as deep as the 900 ft. level, therefore there was no reason to look for its downward continuation. However, there was sufficient ore in that body to keep them busy for some months.

ANNUAL REPORT OF VAN-ROI MINING CO., LTD.

The annual report of the directors of the Van-Roi Mining Co., Ltd., for the year ended September 30, 1913, submitted to the general meeting of shareholders held in London, England, on February 23, contained the following:

Accounts.—The accounts, after writing off £10,715 1s. 4d. as depreciation on development, machinery, buildings, etc., show a balance to the debit of profit and loss of £20,559 7s. 3d., which, deducted from the amount brought forward from last year, namely, £23,711 13s. 5d., leaves £3,152 6s. 2d. to be carried forward. The Board wishes to emphasize the point that practically the whole of the development of the mine has been paid for out of revenue.

Production.—On reference to Messrs. Alex. Hill & Stewart's detailed report, it will be seen that during the period under review 26,617 tons of ore was mined.

The mill ran for 4,271 hours, and 25,702 tons of ore was treated of an average assay of 8.31 oz. silver per ton, 2.28 per cent. lead and 4.99 per cent. zinc. There was produced 688.5 tons of lead concentrate assaying 145.23 oz. silver per ton, 56.8 per cent. lead and 11.38 per cent. zinc, and 841 tons of zinc concentrate assaying 47.46 oz. silver per ton, 4.1 per cent. lead and 43.93 per cent. zinc. The cost of mining was $2.98 per ton, and of concentrating $1.03 per ton.

Development.—There was done 1,891 ft. of drifting, crosscutting and raising at an average cost of $13.68 per ft.

In view of the poor results obtained and on a resurvey of the mine being made, it was resolved to have recourse to diamond drilling with a view to ascertaining whether or not the main vein had forked, and if a more important, or possibly chief branch, existed to the north of Level 9. There was accordingly drilled 998.5 ft., at an average cost of $1.71 per ft. The results, though not finally conclusive, have indicated the existence of a northerly vein, which will be the subject of further exploration.

The Board much regrets that the hopes expressed at the meeting last year have not been justified by results. At that time all the working faces had much improved in grade, and it only required adequate ventilation to proceed with satisfactory and profitable extraction of the ore bodies. Unfortunately subsequent work proved disappointing with a marked falling off in grade at every point. As a consequence of this it became necessary to shut down the mill for some months until development and exploration had opened up fresh ore. The result of this work and systematic diamond drilling has been the discovery of new ore and the partial resumption of milling, and present indications are once more favorable.

The meeting was presided over by Lord Ernest Hamilton, chairman of the company, who after reviewing the year's operations and results moved the adoption of the report and balance sheet, which was done, following an address by Mr. Chas. H. Stewart, of Alex. Hill & Stewart, managers and consulting engineers for the company, who visited the company's mine and concentrating mill near Silverton, B.C., last November. Mr. Stewart informed the shareholders that though the fiscal period ended September 30, 1913, had been an unsuccessful year, the five months subsequent to the closing of that year's accounts had been successful. His belief was that they would continue to make profits. Since November they had made a profit of $15,500, and they were now milling ore at the rate of 2,200 tons a month. This was about half the rate of the successful year they had reviewed at their last meeting. Recent development work done in the Van-Roi mine had been with the object of finding new ore supplies, but they had not yet stoped ore they had found. Their policy was to limit, as far as possible, fluctuation in production, so as to keep up a regular supply of ore for the concentrating mill. Their greatest commercial recoveries were made when they got silver value with the lead concentrate rather than with the zinc, consequently it was economical to hold back high grade ore in lead in order to help the ores that were deficient in that metal. They had been developing high grade lead ore on the 900 ft. level, where for 132 ft. the ore averaged 36 oz. of silver to the ton, with 7.5 per cent. lead. That ore shoot had not been stoped, and it certainly ensured further considerable supplies of ore; but it did more—it showed that in the deepest level of the mine they were getting ore just as good as they had found in the upper levels.

Part of the chairman's comment was: "Those of you who follow closely the fortunes of the Van-Roi mine will have noticed that the last monthly returns show a steady and progressive improvement, and there is every reason to believe that the improvement will continue to be maintained. It is a hopeful feature that our property is of considerable extent. The chief trouble is that there does not appear to be any regular fixed rule to assist mining engineers in forming an exact estimate as to where the ore bodies may be looked for.

GEOLOGICAL SURVEY PUBLICATIONS.

In this issue we reprint extracts from reports on Geology and Mineral Resources of the Tulameen District, B.C., by Charles Camsell, and Bathurst District, Nova Scotia, by G. A. Young. The complete reports, known as memoirs No. 26 and 18, respectively, can be obtained on application to the Geological Survey.

COAL-DUST INVESTIGATIONS.

Mr. J. Taffanel, mining engineer, former French Inspector of Mines and now the distinguished Director of the French Mine Experiment Station at Lievin, is paying a visit to the United States. He is known internationally for his original investigations of coal-dust explosions and means of prevention. He is a guest of the United States Bureau of Mines, while collaborating with Chief Mining Engineer, George S. Rice, and other of the bureau's staff in especial experiments at the bureau's experimental mine near Bruceton, Pennsylvania. Mr. Taffanel arrived in New York from France on April 12, and proceeded immediately to Pittsburgh, where he has been busily engaged in the tests and in studying the records of past tests at the experimental mine, the final object of which is to diminish the danger of coal-dust explosions. While fire-damp is a serious menace, its effects if ignited, would be local if dry coal-dust was not present to extend the explosion throughout the mine.

Mr. Taffanel's studies at Pittsburgh and Bruceton were interrupted by the news of the disaster at the Eccles Mine, West Virginia, to which he went with Mr. Rice for an investigation. This is not Mr. Taffanel's first investigation of an American mine disaster. In 1907, on behalf of the French Association of Coal Operators, which has established the Lievin Station as a result of the great Courrieres disaster of 1906, he came over to investigate the terrible Monongah disaster with 356 victims, and while here investigated the Darr Mine and Naomi Mine explosions. He has also investigated the large British mine disasters of recent years, including Hulton and West Hanley Collieries and the recent great disaster at the Universal Colliery at Senghenidd, South Wales.

Besides the explosion investigations, Mr. Taffanel carries on at the Lievin Station, tests of safety lamps, explosives and mine-rescue apparatus and he has an organized crew of rescue men ready to visit any mine disaster in Northern France.

In response to inquiry, Mr. Taffanel said, "I came to this country with the purpose of studying in collaboration with the Bureau of Mines and the Chief Mining Engineer, Mr. Rice, some questions concerning the danger of coal dust and the means of prevention of this danger.

"I began the experiment on this subject in 1907, when the Coal Mine Owners' Association of France decided, some months after the Courrieres disaster, to organize the experimental station at Lievin. I have made up to now more than 1,400 explosions in the experimental gallery and collected a considerable amount of data concerning the relative danger of many coal dusts or coal and stone-dust mixtures. Although they are pursued on a big scale, in a gallery 1,200 ft, long, the experiments at Lievin do not realize exactly the condition of the mine, and the results must be checked

by means of comparative tests in an actual mine. I made such tests last year, in an abandoned passage way of the Community Mine, in France, but was obliged to stop after an explosion which destroyed a part of the passage way. In two months, I will make tests of the same kind in another abandoned French mine at Montvicq. In the meantime, I was very glad to be invited by the Bureau of Mines to follow the experiments in the Bruceton Mine, which is perfectly equipped for such experiments. I find a great profit in studying the very important results obtained in this mine by Mr. Rice. Moreover, the experimental comparison of the Lievin and Bruceton results is doubly important as it gives a confirmation of the Lievin results under the real conditions of the mine. It allows to be taken into account the large amount of data obtained at Lievin for the application to the Bruceton Mine or, generally speaking, to the American mines.

"Some years ago, I designed the first form of arresting barriers which have proved, in many tests, to be effective for stopping coal-dust explosions. About one year and a half ago, I began studying new forms of arresting barriers, i.e., tanks or boxes, containing a great quantity of extinguishing materials, water or stone-dust, and automatically opened by the air wave preceding the flame. Mr. Rice has followed paralleled studies and we find a great profit in collaborating for improving these devices in order to get the most practical and effective solution.

"The coal-dust problem is a very difficult problem of international interest. All countries which have undertaken to minimize this great danger must unite their efforts."

MINING ACCIDENTS IN ONTARIO.

Mr. T. F. Sutherland, Chief Inspector of Mines, Ontario, reports that during the first quarter of 1914 there were 17 fatal accidents, causing the death of 20 men, at the mines, metallurgical works and quarries regulated by the Mining Act of Ontario. The quarries include quarries proper, clay banks, and sand and gravel pits.

In and about the mines 8 men were killed; 6 of these fatalities occurred underground, and 2 on the surface. At metallurgical works 5 men were killed, 2 of the fatalities resulting from railroad operations. In the quarries there were 6 fatal accidents, resulting in 7 men killed; 4 men were killed in clay pits, 2 in sand and gravel pits, 1 in a quarry proper.

The increase in the number of fatalities reported from quarries is due to the efforts being made by this Department to obtain complete returns of such accidents. It is not believed that complete returns are yet being obtained from such works. The inspectors have found that such work is conducted in a much more hazardous manner than underground mining operations. This is due to several causes—the majority of such works employ only from 4 to 10 men and work intermittently; the men employed are unskilled and unacquainted with the danger of their work; there is not usually intelligent supervision of the work, the main thought being to get out the material as cheaply as possible. Clay banks and gravel pits are undermined and allowed to fall from their own weight. If a workman is caught, the blame for the accident is immediately thrown on him by the management; if he refuses to work under such conditions, he is discharged.

Climatic conditions were responsible for 6 fatalities. On January 13th, the coldest day in lower Ontario for 20 years, 4 men were killed in 2 accidents, both accidents being due to the unusually low temperature. The first warm weather in the second week of March resulted in conditions responsible for 2 fatal accidents.

It is only fair to draw attention to the fact that the classification adopted by this department is very wide, and includes some fatalities which might reasonably be omitted as not being due to actual mining operations.

R. L. Brooks, the night superintendent of the Canadian Furnace Co. at Port Colborne, jumped into the bell of the blast furnace (refusing to wait for a rope) in a heroic but foolhardy attempt to rescue one of his employees.

An employee of the Porcupine Miracle Mining Co., while off duty, was killed in a shaft accident. A teamster employed by a city contractor was killed at Ellins' gravel pit, Toronto, through refusing to obey the pit foreman and persisting in loading at a dangerous place. An employee of the Dominion Bridge Co. was killed on the steel construction work at the Dome mill, South Porcupine. In these three cases the deceased at the time of the accident was not under the control of officials of the mining company.

Louis Pizzoletti, who had his back broken in an accident at the smelter of the Mond Nickel Co., Victoria Mines, on September 16th, 1912, died at St. Michael's Hospital, Toronto, on January 25th, 1914.

K. O. Olsen, who had his back broken in the cave-in at the Creighton mine on December 9th, 1913, died in the Toronto General Hospital on March 21st, 1914.

William Janes, Canadian, aged about 40, married, and employed at the Cobalt Lake silver mine as a foreman in charge of the cutting to lower the water in Cobalt lake, was instantly killed about 8.30 a.m., January 20th, 1914, by the fall of a derrick.

G. Holovaci, Roumanian, aged about 26, unmarried, employed at the Cobalt Townsite silver mine as a hammer-drill runner in the Townsite mine, Cobalt, fell down a raise about 8.30 p.m., March 17th, and died as a result of his injuries March 24th, 1914, in the Cobalt Mines Hospital.

John Johnson, Finn, aged between 40 and 45, married, with a wife and three children in Cobalt, was instantly killed about 11.30 a.m., March 7th, by a fall of rock in stope 29 east, in the Crown Reserve mine.

Napoleon Roy, of Point Levis, Quebec, aged 36, single, employed as a riveter by the Dominion Bridge Co., contractors for the steel work of the extension to the stamp mill at the Dome Gold mine, fell 40 feet from a scaffold, about 10 a.m., January 26th, and died at 1.15 that afternoon from injuries received in the fall.

James Dunn, English, aged about 38, single, employed as a driller, was killed about 4.45 a.m., February 24th, by falling out of the bucket, or by a round of shots in the shaft of the Hewitt Lake Mining Co.'s prospect at Gowganda.

Maxim Mushta, Russian, aged 32, married, employed as a shoveller, was killed shortly before 5 p.m. January 18th, by falling down the shaft at the Miracle mine in Langmuir township. Mushta had been in the employ of the company about two months, and was a good workman, but one of the worst offenders in the practice of riding the bucket.

Edwin Mattson, Finn, aged 26, married, employed as drill runner, and Hunka Kalari or Hugo Kalliomaki, Finn, aged 27, married, employed as drill helper, were found dead in 43 raise of the Garson mine of the Mond

Nickel Co., Limited, at 6.30 a.m. March 28th. Death was due to carbon monoxide poisoning, the bodies showing to a very marked degree the post-mortem cherry red discoloration.

Peter Rofel, an Austrian, aged 45, married, employed as a keeper at No. 3 blast furnace of the Algoma Steel Corporation, received burns about the face and body on February 1st at 5.50 p.m., which resulted in his death at the Sault General Hospital on February 4th, at 2 p.m. The deceased had been in the employ of the company around the blast furnaces for three years.

James Doyle, a Canadian, aged 20 years, unmarried, employed as a brakeman for the Algoma Steel Corporation, received injuries while riding on the footboard of an engine in the blast furnace yard on Thursday, February 5th, at 11.15 a.m., which resulted in his death at the Sault General Hospital at 1.15 p.m. of the same day.

Robert Lester Brooks, aged 47, Canadian, married, and Ernesto Tisiott, aged 16, Italian, single, were asphyxiated, and found in the second or large bell of the blast furnace at the works of the Canadian Furnace Co., Ltd., Port Colborne, about 8 p.m. on Tuesday, January 13th.

H. Benoit, a Canadian, aged 20, single, employed as a brakeman in the smelter yards of the Mond Nickel Co., Coniston, was injured in a wreck at 5.50 p.m., January 15th, receiving injuries which resulted in his death at the Sudbury Hospital on the morning of January 18th.

Francesco Sicilia, an Italian, aged 35, married, employed as a laborer in the clay pit of the Dominion Sewer Pipe Co., at Aldershot, was instantly killed at 7 p.m., March 13th, by being crushed under the electric shovel when it overturned.

Dennis McCluskey, English-speaking, aged 22, single, employed as a teamster by contractor John Mullin, of Toronto, was instantly killed by a fall of ground in the gravel pit of Wesley Ellins, Scarlett road, York township, at 1.30 p.m., March 14th.

Victor Pevi, Finn, unmarried, aged 33, received injuries on March 4, 1914, about 11 a.m., in the quarry of the Intercities Quarry Co., near Port Arthur, from which he died the following day.

Joseph Bowers, a native of England, aged 36, married, living with his wife and family of five children at Glenburnie, and employed as steam truck engineer by the Kingston Sand & Gravel Co., was struck by a large lump of frozen sand at the pit of the company, 11 a.m. March 3rd, receiving injuries which caused his death three hours later.

On January 13th, in the clay pit of James Pears & Son, 118 Eglinton avenue, Toronto, George Woodhouse, a Canadian, aged 50, married, employed as a laborer, and Henry Martin, a Canadian, aged 35, married, laborer, were killed by being struck by a fall of clay which was being undermined.

Edward Smith, a Canadian, aged 35, married, employed as foreman at the Russell Brick works, 40 Blake street, Toronto, was instantly killed by a fall of clay at 2.30 p.m., February 25th.

The Canadian Pacific Railway Co. is preparing to complete the work of standardizing the Kaslo & Slocan Railway, well advanced, before the winter's snow became too deep to allow of work being continued. Shipment of ore from the Utica mine will be resumed as soon as transportation shall be provided.

BOOK REVIEWS

A TEXT-BOOK OF GEOLOGY—By James Park, Professor of Mining in the University of Otago, N.Z.—Charles Griffin & Co., Ltd., London—Price, Fifteen Shillings.

This book of 554 pages has been written for use in mining schools, colleges and secondary schools. It comprises a systematic course of lectures, carefully revised and expanded. It is well illustrated with halftones and drawings.

There are three parts.

Part I. (pp. 1-299) deals with first principles, scope of geology, denudation of the land, work of stream and rivers, snow and glaciers, geological work of the sea, rock-building, rock structures, earth movements, joints, faults, cleavage, composition of the earth's crust, rock-forming minerals, sedimentary rocks, volcanoes and volcanic action, igneous rocks, plutonic, hypalyssal and metamorphic rocks, fossils, conformity and unconformity.

Part II. (pp. 300-503) is historical. The several eras and systems are taken up in order, the chapters being headed: History of the Earth, Eozoic Era, Paleozoic Era, Ordovician System, Silurian System, Devonian System, Carboniferous System, Perinian System, Mesozoic Era, Triassic System, Jurassic System, Cretaceous System, Canozoic or Tertiary Era, Miocene and Pliocene, Pleistocene and Recent, Development of Surface Features.

Part III. (pp. 504-550) is devoted to economic geology and the elements of field geology and geological surveying.

Appendix A gives method of converting magnetic bearings to true bearings. Appendix B describes the determination of strike and dip from contured maps.

There is a short bibliography and a voluminous index.

COMPRESSED AIR—A Treatise on the Production, Transmission and use of Compressed air—By Theodore Simons, E. M., C. E., Professor of Mining Engineering, Montana State School of Mines—McGraw-Hill Book Co., 1914—Price $1.50—Fore Sale by Book Department, Canadian Mining Journal.

In this book of 167 pages Professor Simons presents the principles underlying the production, transmission and use of compressed air, without attempting extensive descriptions of all existing types of compressors and the countless appliances using compressed air.

It is designed essentially as a text-book, to give the student a thorough grounding in principles, with emphasis on practical applications, and problems to make clear and fix the subject in the student's mind.

There are four parts. The first three are devoted respectively to production, transmission, and use of compressed air. The fourth deals with air compressors and accessories. The contents are indicated by the following chapter headings:

The Physical Properties of Air. Definition of Terms Used in Discussing Compressed-Air Problems. Behavior of Air Undergoing Compression and Under the Application of Heat. The Compression of Air in Air Compressors. Theory of Air Compression. Clearance, Volumetric Efficiency, Capacity, Speed, Mechanical Efficiency of Compressors. Two-Stage and Multi-Stage Compression, also Known as Compound Compression. Effect of Altitude on Air Compression. The Compressed Air Indicator Card. Cooling Water Required in Compression; Efficiency of Compressor Plant; Air-Compressor Explosions.

Transmission of Compressed Air. Dimensions of Pipe Lines for Conveying Compressed Air.

Theory of Air Engines. Effect of Loss of Heat, Generated During Compression, on the Ultimate Useful Energy Residing in a Given Quantity of Compressed Air. Internal or Intrinsic Energy of Air. The efficiency of a Compressed Air System. Reheating of Compressed Air.

Examples of Modern Air-Compressors of the Reciprocating Type. Important Mechanical Features of Air Compressors. Compressor Accessories.

PROPOSED T. & N. O. RAILWAY EXTENSION TO JAMES BAY

By J. G. G. Kerry,
Consulting Engineer, T. & N. O. Ry. Commission.

The construction of the Temiskaming and Northern Ontario Railway was commenced about the year 1900, the enterprise being undertaken by the Provincial Government of that date in a somewhat blind compliance to the popular demand that a very definite effort should be made to open up the large and unknown area of land that lay to the north of the main line of the Canadian Pacific Railway and between the north shore of the Great Lakes and the south shore of Hudson's Bay. Almost simultaneously, the Provincial Government sent out a number of exploring parties throughout this area. These parties were in charge of various members of the Ontario Association of Land Surveyors, and from their reports the province first learned of the existence of that large area of arable land that is now known as the Clay Belt, and shown in Fig 1.

Fig. 1

The importance of this so-called Clay Belt, not only to the Province of Ontario but to the Dominion of Canada at large, cannot be over-estimated. A study of the geographical distribution of our population at the present time will show that it consists of one large and rapidly growing unit which is located entirely to the west of the line of Lake Winnipeg. A second and larger unit is located entirely to the south and east of a line joining Orillia and Pembroke. The district lying between these two lines, with the exception of such towns as North Bay, Sudbury and Port Arthur, may be said to be entirely unsettled; this was absolutely true little more than 10 years ago, and in large measure remains true to-day. A possible result of the existence of so definite a cleavage in the settlement of the Dominion is the growth of a distinct west and a distinct east. From a national point of view this, more than any other one thing, is what we all desire to prevent and no effort should be spared that will tend to keep this possibility from becoming a reality.

Examining a map, such as Fig 1, upon which the outline of the Clay Belt is marked, it will be seen that this Belt, which consists of most fertile land, stretches almost half way across the unsettled area which at present divides the Dominion. The writer, therefore, regards the work of the commission in opening up the Clay Belt for settlement as possibly the most important national work now in progress in Canada.

Other organizations are also active in this work of development; the Algoma Central Ry. is building in from the south and west; the National Ry. is tra-

From an address to the Toronto Branch, Canadian Society of Civil Engineers, March 26th, 1914, published in The Canadian Engineer, May 7.

versing the Belt from west to east. The next work of importance would, therefore, appear to be the establishment of an outlet to the north and the establishment of a rail connection with the only ocean line within the confines of the Province of Ontario. With such an end in view the commission has directed the carrying-out of the investigations that are discussed in this paper.

The most attractive location for the proposed terminal so far as present information goes, is at the mouth of the Moose River, as shown in Fig. 2, and this point may be referred to as Moose Harbor. It may be remarked that by far the larger portion of the Clay Belt is drained by the tributaries of the Moose River

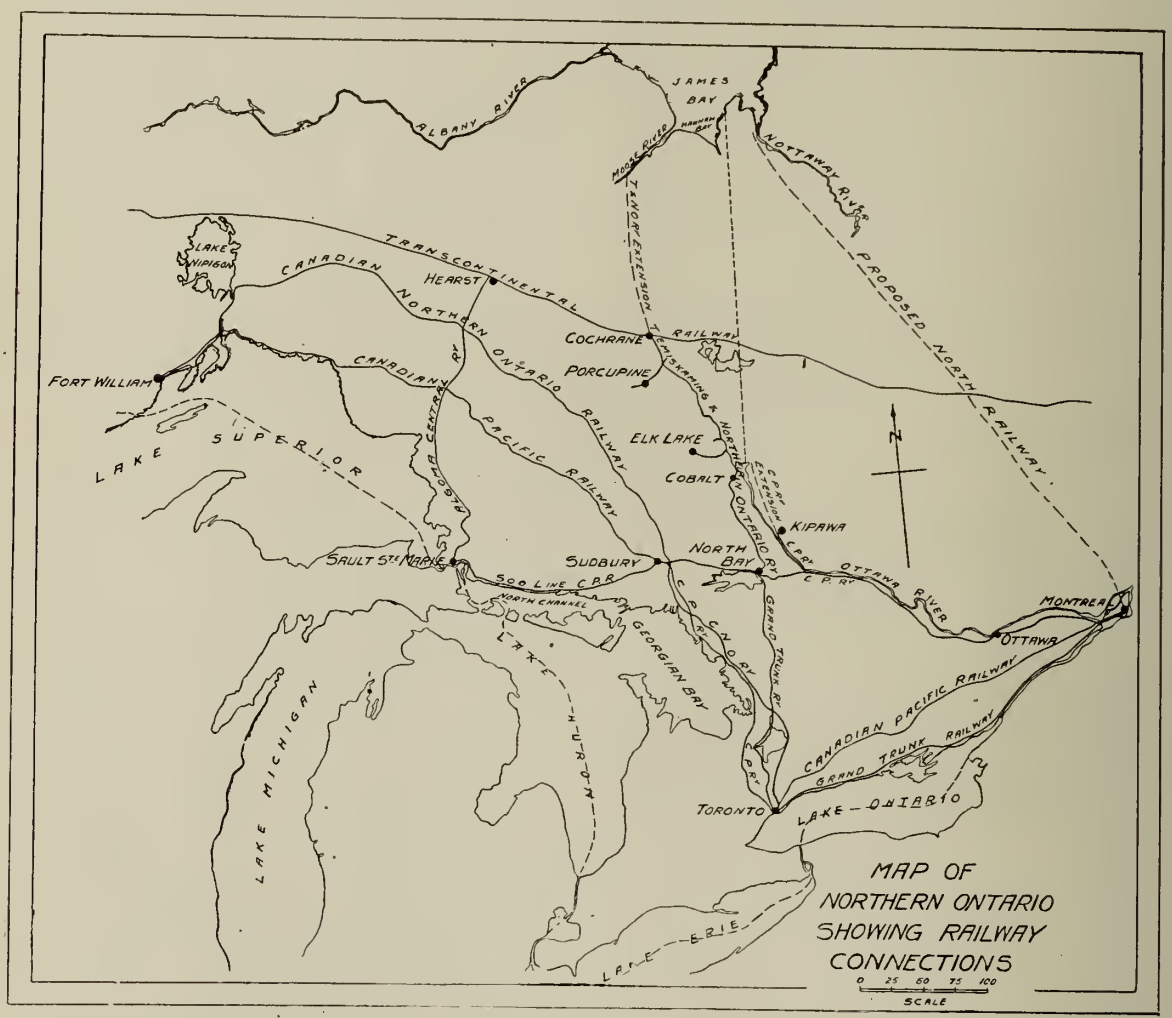


Fig. 2

and that the natural movement of traffic will be along the line of these tributaries with a natural point of concentration at the harbor. Geographically speaking, Moose Harbor is not an isolated point and does not lie in an extreme corner of the possible confines of civilization. If on Fig. 1 a half circle is drawn with the harbor as centre it will be found that, without very material change of radius, Winnipeg, Port Arthur, Toronto, Ottawa, Montreal and Quebec can be reached, and it may reasonably be expected that in the not-distant future a commercial centre of some importance will exist near the harbor, and that this centre will transact business directly and independently with each of the cities that have just been mentioned.

A journey from Toronto to Moose Harbor after the completion of the railway extension will not be an arduous undertaking. The distance can readily be run within 24 hours, and, as a matter of illustration, the run may readily be compared to the present journey from Montreal to Chicago, or from Toronto to Port Arthur; in each case the distance between the points mentioned is rather greater than the distance from Toronto to Moose Harbor will be, this distance being roughly estimated at 670 miles.

The enterprise of extending the Temiskaming and Northern Ontario Railway to the Bay must be regarded as one of colonization and development; it is not possible to prove from statistics of present traffic that the undertaking will be a commercial success, the simple fact being that no traffic at present exists, although there is every reason to believe that natural resources abound from which an important traffic can be created.

The tributary district to the railway will consist not only of the Clay Belt, but also of the well-defined area of clay lands lying along the shores of James Bay, and geologically known as the Coastal Plain. The soils of this Plain bear much resemblance to those of the Clay Belt, and their development presents in a larger degree the same problems that have to be dealt with in the development of the Clay Belt. Where satisfactory means of drainage exist, the growth of the various species of northern timber proves the fertility of the soil, but the geologists regard the whole district, and particularly the Coastal Plain, as being of very recent creation. The drainage system is, therefore, quite imperfectly developed and large areas of land are buried

under muskeg and moss. The condition is indeed very similar to that which exists on the prairies to the east of Winnipeg, the lands being so flat-lying that their slope is not sufficient to provide for the quick discharge of the melting snows in the spring and the formation of muskegs and swamps naturally follows. The natural slope of the lands is, however, sufficient to enable the engineers of the future to design and construct drainage work on a comprehensive scale that will be perfectly satisfactory in their operation, and with the construction of such works practically the entire area of the district will become available agricultural land.

Much of the district is already efficiently drained by the natural watercourses, and the colonizing energy of the province is for the present being concentrated on the settlement of these lands. In general, such lands carry a healthy growth of spruce wood of sufficient size to be valuable as raw material for pulp and paper mills. Intelligent development of such lands, therefore, provides work for the settler both in summer and in the winter. The clearing-up of the lands is, comparatively speaking, easy work, and the timber as it is cut finds a ready market.

The tributaries of the Moose River have direct courses on their way to the Bay and a relatively heavy fall per mile. As a consequence, numerous sites are found where water power can be cheaply developed,

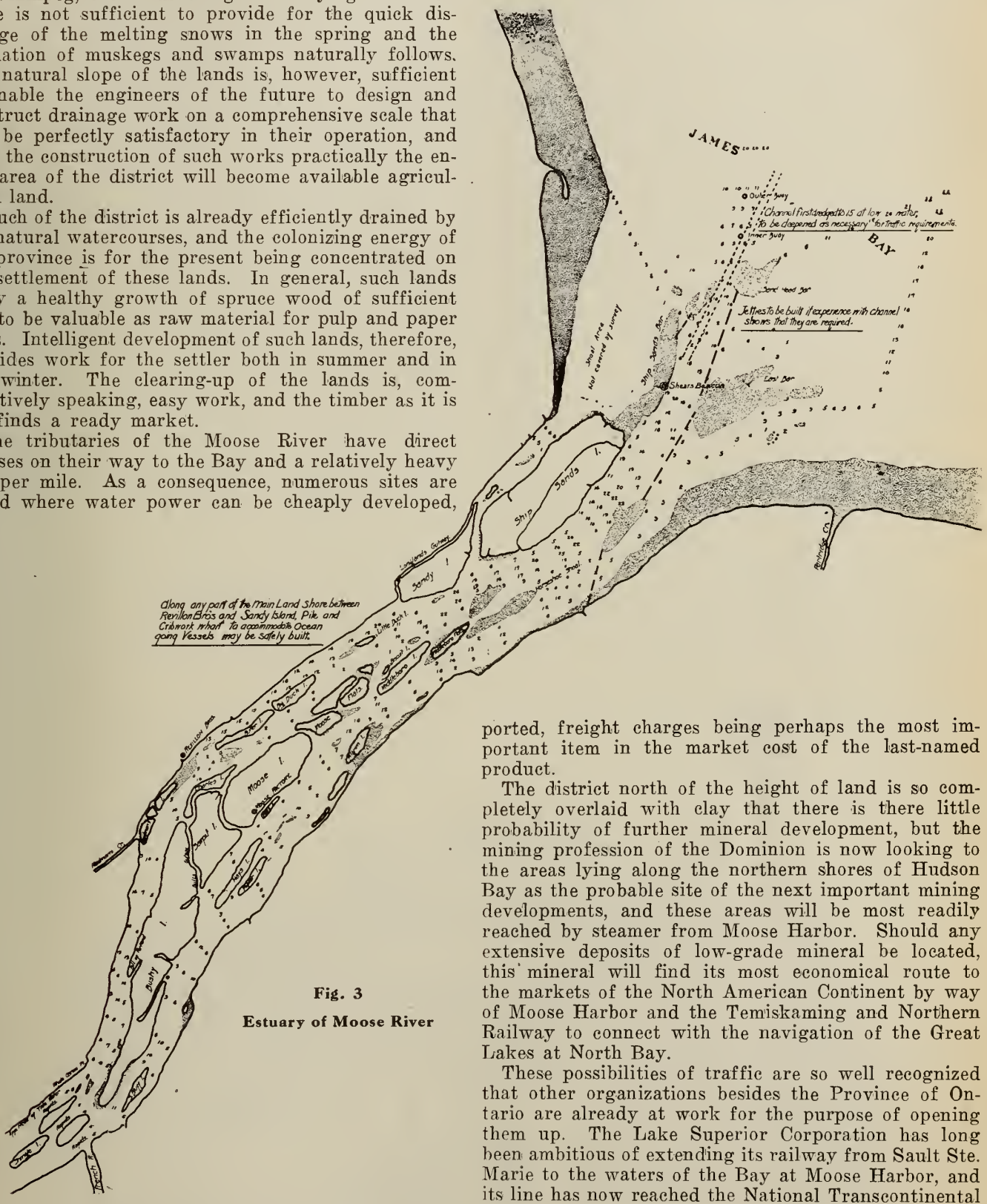

JAMES
BAY
Outer buoy
Inner buoy
Channel first dredged to 15 at low water, to be deepened as necessary for traffic requirements.
Jetties to be built if experience with channel shows that they are required.
Shoal area not covered by survey
Ship Sands
Shears Beacon
Low Bar
Sandy
Along any part of the Main Land Shore between Revillon Bros and Sandy Island, Pile and Cribwork wharf to accommodate Ocean going Vessels may be safely built.
Moose
Moose Harbour
Revillon Bros
Hudson's Bay Co.

Fig. 3

Estuary of Moose River

and one of the early industries of the district will be the manufacture of pulp and paper. This has been already undertaken on a large scale at Iroquois Falls which itself is not distant more than 200 miles from the Bay.

In this development the opening of a port on the Bay must play a considerable part, providing a route by which such necessary materials as coal can be brought in without excessive freight charges and such low-grade materials as groundwood pulp can be exported, freight charges being perhaps the most important item in the market cost of the last-named product.

The district north of the height of land is so completely overlaid with clay that there is there little probability of further mineral development, but the mining profession of the Dominion is now looking to the areas lying along the northern shores of Hudson Bay as the probable site of the next important mining developments, and these areas will be most readily reached by steamer from Moose Harbor. Should any extensive deposits of low-grade mineral be located, this mineral will find its most economical route to the markets of the North American Continent by way of Moose Harbor and the Temiskaming and Northern Railway to connect with the navigation of the Great Lakes at North Bay.

These possibilities of traffic are so well recognized that other organizations besides the Province of Ontario are already at work for the purpose of opening them up. The Lake Superior Corporation has long been ambitious of extending its railway from Sault Ste. Marie to the waters of the Bay at Moose Harbor, and its line has now reached the National Transcontinental Railway. The Dominion of Canada is building its grain railway to the waters of the Bay at Port Nelson and the Province of Manitoba is planning to reach the same point by an independent line along the east shore of Lake Winnipeg. The Province of Quebec, following its customary policy, is granting heavy subsidies to the North Railway, which is intended to establish a connection between the south end of the

Bay and the Port of Montreal. It seems proper, therefore, that action on the part of the Province of Ontario should not be long delayed.

We cannot be accused of being unduly hasty in the development of our railway facilities for the opening up of the north. The rail end reached Orillia shortly after 1870, it reached North Bay about 1886, and was continued from North Bay to Liskeard between 1900 and 1905, and on to Cochrane about 1910, an average movement northward of perhaps 10 miles per year.

Historically, Moose Harbor, under the name of Moose Factory, is an old and long-settled port, from which the business of the surrounding country has been handled for nearly 250 years. Generations of people have lived and died there, and the suitability of the site as a point of permanent residence is beyond question. It is interesting to note that one of the earliest experiences of this settlement was its complete destruction in a time of peace by a marauding, overland expedition sent out from Montreal—apparently with the definite intention of maintaining the supremacy of that city as the centre of the fur trade. In fact, the commercial possibilities of the Bay received more attention between the years 1670 and 1700 than they have at any other time up to the present.

Moose Harbor provides a magnificent site for the creation of a great port. The estuary, shown in Fig. 3, is perhaps 20 miles long and varies from 1½ to 3 miles wide. It is crowded with islands, and through the intervening channels there discharges the great river which is never, so far as we know, smaller than the Ottawa River has been since the government has regulated the flow of that stream by its storage works. The settlements and fields on the islands give evidence of long occupation, and the flat-lying shores provide an ideal site for a rail and water terminal.

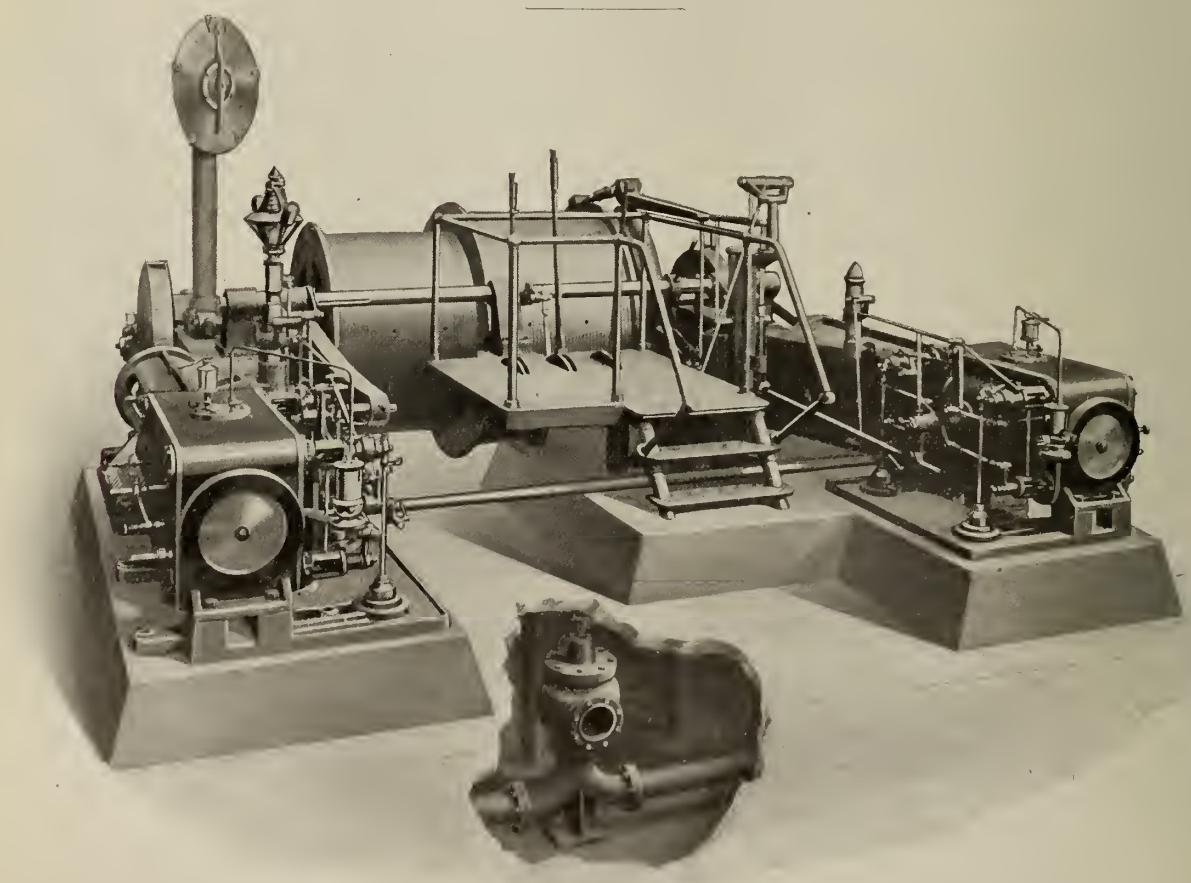
PORCUPINE VIPOND MINES, LTD.

In a circular to stockholders, Mr. H. H. Ward, president of Porcupine Gold Mines Co., says in part:

"An Ontario corporation, known as the Porcupine Vipond Mines, Limited, has been incorporated with a capital of $1,500,000, shares par value at $1 each, of which 750,000 shares are placed in the treasury for development purposes, and 750,000 shares will be given to the holders of the present Porcupine Gold Mines stock in the proportion of three shares for each eight shares they now hold in the Porcupine Gold Mines Company. Three hundred thousand shares of the treasury stock of the new company have been underwritten under an agreement which provides that shareholders of the Porcupine Gold Mines Company may subscribe for the same at 30 cents per share, all stock not subscribed for by shareholders to be taken up by the underwriters under their contract with the Porcupine Vipond Mines, Limited.

"The arrangement concluded as set forth above, is regarded as most advantageous to shareholders, not only because their existing interests have been protected, but because they are given such subscription rights as enable them to preserve at a favorable price their full proportionate interest in the Vipond property.

"Our original plans of development, halted on account of lack of funds, will now be immediately resumed. Contracts for machinery for cyanide plant have been signed, and work will be resumed at the mine within the coming week. You will be informed from time to time of the progress made."



HOIST RECENTLY INSTALLED AT BEAVER MINE, COBALT, ONT.

THE VERTICAL RANGE OF METALS DEPOSITED BY SECONDARY PROCESSES

By William Harvey Emmons, Professor of Geology, University of Minnesota, U.S.A.

The theory of sulphide enrichment announced independently in 1900 by S. F. Emmons, W. H. Weed and C. R. Van Hise, has been successfully utilized in the exploration of so many mineral deposits that it has become an accepted tenet of applied geology. The processes involved are assumed to include, (1) solution of the valuable metals in an oxidizing acid environment in advance of the removal by erosion of the outcrop of the ore body; (2) transportation by descending meteoric waters of the metals dissolved; and (3) precipitation of the valuable metals in depth where the environment is reducing and perhaps alkaline.

Although our knowledge concerning the details of the chemistry of the processes is inadequate, the general nature of these chemical processes is fairly well understood. Few geological processes lend themselves more readily to experimental study. The mineral waters, as shown by study and comparison of numerous analyses of mine waters, may reasonably be assumed to be dilute solutions of sulphates and chlorides. The conditions of temperature and pressure which prevail are not very different from those obtaining in the laboratory. Hence the behaviour of the various minerals and ores in the presence of solutions like mine waters may easily be determined. By close correlation of field observations and laboratory experiments, it appears probable that in the near future we will know many of the details of the processes as well as we now know the nature of the general laws that operate in the weathering of a body of sulphide ore.

These processes are influenced by many factors. Among those of environment are temperature, rainfall, altitude and relief. An important physical factor is the permeability of the deposits. And so many geological events may affect, in one way or another, the operation of the processes of enrichment that the use of the theory is fraught with danger unless it is applied with an adequate knowledge of the geology of the region containing the deposits.

A review of the distribution of sulphide deposits having secondary zones shows that they are present at high and low latitudes, at high and low altitudes, in moist and in dry climates. They are present also in hot and in cold countries, although they are less numerous in high latitudes, especially in countries where Pleistocene glaciation has removed much of the surface.

On the other hand, many mining regions contain deposits with rich secondary zones, while other sulphide deposits that have weathered in the same region and under similar physiographic conditions, exhibit no evidence of appreciable enrichment. In general, such differences in the behavior of deposits, under approximately similar conditions have been attributed to differences in their permeability; and very correctly so, for in impermeable deposits the solutions cannot descend, and the valuable metals that may be dissolved in the upper portions of a deposit cannot be precipitated in the impermeable lower regions. Permeability is, however, a relative term and it is doubtful whether any deposits are altogther impermeable.

Another factor that influences the depth at which metals may be deposited is the chemical and mineralogical environment. If the conditions in the oxidizing zone are favorable to solution, the metals will be dissolved; if they are unfavorable to solution the metals will remain to enrich the outcrop or to be carried away by processes of erosion. If the chemical environment in the lower unoxidized regions is favorable to rapid precipitation, the valuable metals will be precipitated before the downward moving solutions have migrated to great depths. The secondary zone may contain very rich ore, but the vertical extent of the latter will be less in consequence. On the other hand, if the minerals that compose the primary ore are those that react but slowly with the downward moving secondary solutions, precipitation of the metals will not be accomplished so readily, and the metals dissolved in the higher oxidizing environment may be carried downward to considerable depths. In deposits composed of such minerals the vertical extent of the secondary ores will be much greater than in deposits containing minerals that quickly precipitate the valuable metals.

If the behavior of solutions like mine waters containing gold, silver and copper in low concentration, toward each of the minerals of an ore and toward mineral associations were known, from experiment, and if the permeability of the deposit were ascertained, some estimate might be hazarded, perhaps in advance of extensive exploration, as to whether the secondary ores of a deposit would extend downward to considerable depths or whether they would be restricted vertically.

Examination and study of about fifty analyses of waters of gold, silver, and copper mines indicate that mine waters are fairly constant in composition. Near the surface they are acid sulphate and ferric sulphate waters. At greater depths they are acid ferrous sulphate waters, and deeper still they become alkaline ferrous sulphate waters. If the behaviour of such waters toward a given ore were known, and if the rate at which the solutions, under the several conditions of acidity and alkalinity, attack the primary ore were determined by experiment, much light might be thrown upon the superficial processes and upon the rate at which they operate under a known set of conditions.

Gold.—Gold, silver and copper are nearly related chemically and stand apart as metals in the concentration of which the processes of sulphide enrichment are most clearly expressed. They are dissolved in an oxidizing sulphate or chloride environment and are readily precipitated in a reducing, less acid, environment. Any one of them is readily precipitated by calcite, siderite, pyrrhotite, and probably by several sulphides. Under conditions that prevail in the oxidizing zones of ore deposits, gold is dissolved probably only in the presence of a chloride and oxidizing agent. The most important oxidizing agents in gold enrichment are doubtless manganese oxides, for these not only supply nascent chlorine by reaction with chlorides in solution, but inhibit the accumulation of ferrous sulphate that immediately precipitates gold from chloride solutions. In the deeper regions where oxides are reduced or acids are removed to form inert salts, gold is precipitated. Ferrous sulphate is doubtless an important precipitating agent, but many common ore and gangue minerals are also effective. As

A paper read at Toronto session International Geological Congress, August, 1913.

stated by Brokaw, the list includes many native metals, sulphides, sulph-arsenides, sulph-antimonides, etc. Of the gangue minerals calcite siderite, and some other carbonates throw down gold at once. Even comparatively stable minerals, like the feldspars and micas, give a distinctly alkaline reaction, and, given time enough, an auriferous sulphate and chloride solution would be neutralized and gold would be precipitated by many minerals of the gangue and of the wall rock.

Thus secondary gold ores might form in any deposit where conditions are favorable to solution of gold, but in a deposit composed of minerals that preciptate gold quickly, any gold dissolved would not be carried to great depths and the secondary ores would remain at least temporarily near the surface. One would not suppose that gold deposits containing much pyrrhotite or calcite or siderite would have as deep secondary zones as deposits containing only pyrite, quartz, feldspar, mica, and other minerals that react but slowly with the solutions.

Silver.—Like copper, silver dissolves readily in dilute sulphuric acid, and silver sulphate is dissolved by sulphuric acid if a little ferric sulphate is present. Unlike gold, the solution of silver does not require the presence of a chloride, and unlike copper silver forms stable chlorides in the oxidized zone. If the descending mineral waters carry much chloride, silver tends to accumulate as cerargyrite, but silver chloride is itself somewhat soluble in water and more soluble in concentrated solutions of alkaline chlorides. Thus silver, even in deposits where the chlorides form, may be carried downward in solution and be precipitated at depths where conditions are reducing. Acid sulphate, reacting on pyrrhotite and some other minerals, as shown by Wells, will generate hydrogen sulphide, and hydrogen sulphide precipitates silver sulphides even from highly dilute solutions. Silver is precipitated also from sulphate solutions by stibnite, realgar, and orpiment.

Solutions of ferric sulphide reacting with hydrogen sulphide give powdery sulphur, and as shown by Cooke, amorphous sulphur unites with silver sulphate to form silver sulphide, probably argentite.

The downward migration of silver in sulphide deposits is delayed not only by formation of the chloride, but also by precipitation of the native metal. Some recent experiments by Palmer and Bastin have a bearing here. Several minerals treated with silver sulphate precipitated native silver. The reaction was rapid with chalcocite, covellite, enargite, bornite, and tennantite; less rapid with smaltite, pyrrhotite, chalcopyrite, and arsenopyrite; and weak or inactive with stibnite, pyrite, galena, millerite, and sphalerite.

Mr. F. F. Grout has shown that these relations will hold approximately where the solutions have acid in excess, and that carbonates,—calcite, siderite, rhodochrosite, and several others—precipitate silver rapidly after the acid is used up.

In deposits of ores of silver that contain abundance of the minerals that readily form the native metal in the presence of silver sulphate, one would suppose that the zone of secondary native silver would be rich, but that it would not have such great vertical extent as in deposits composed only of quartz pyrite, and other less active minerals. Even in deposits composed of relatively inert minerals, precipitation of silver would take place ultimately if the deposits were sufficiently permeable to permit a downward migration of solutions. Silver would be precipitated even on feldspars or other minerals of the wall rock, for, as Sullivan has shown, this reaction takes place with surprising rapidity.

But the migration of silver is not permanently delayed by precipitation in the form of halides and native metal, for dissolving again in ferric sulphate solutions, it passes downward to form argentite and the complex antimony and arsenic sulphides. In many deposits, as in the Comstock Lode and at Tonopah, Nevada, these are the most important minerals. But little is known concerning the chemistry of their genesis. It is known, however, that many deposits of secondary silver sulphides are bottomed by sphaleritic ores, the zone of transition from rich to poor ore being at many places comparativaly narrow. In view of Wells' experiments showing that sphalerite reacts readily with dilute acid to yield hydrogen sulphide, one might suppose that the decomposition of sphalerite had released compounds that were effective in precipitating silver. On the other hand, some sphaleritic deposits have relatively deep secondary zones.

Some recent work by Mr. F. F. Grout indicates that these salts are probably precipitated in an alkaline environment, where alkaline sulphides accumulate, will form in depth silver sulphides and complex silver salts instead of the native metal. The bottom of the zone of native silver does not indicate, therefore, the lower level of the zone of superficial alteration.

Copper.—Like gold and silver, copper is dissolved in acid sulphate and chloride solutions, in an oxidizing environment. Unlike gold, the presence of chlorine is not necessary for its solution, and unlike silver, it is rarely precipitated as chloride in the oxidizing zone. The native metal and its oxides, silicates, carbonates and sulphates may form directly from solution, but much of the rich oxidized ore composed of these minerals has doubtless resulted from the oxidation of a relatively rich sulphide ore that by processes of erosion has been exposed to oxidizing conditions. In ores containing abundant calcite, as pointed out by Bard, there is a strong tendency to delay the downward migration of copper by the formation of relatively insoluble copper carbonates in the upper regions.

The secondary sulphide zones in copper deposits are more clearly expressed than in the deposits of precious metals. This, I believe, is because the copper sulphides dissolve in acid sulphate very readily in an oxidizing environment, but are highly insoluble in acid in the absence of oxygen. In many districts, pyrite, pyrrhotite, sphalerite, or galena have been replaced by chalcocite. Acid waters reacting on some of these minerals liberate hydrogen sulphide, and since copper sulphide has an exceedingly low solubility, hydrogen sulphide will precipitate copper from dilute solutions. It is not certain that hydrogen sulphide is an intermediate product where the primary sulphides are replaced by copper, yet it is believed that the rate at which those minerals are attacked affords a kind of index to the rate at which they will reduce a copper sulphate solution. If so, pyrrhotite which yields hydrogen sulphide more rapidly than pyrite and chalcopyrite in acid solution, should bring about the precipitation of copper more readily than pyrite and chalcopyrite. The same relation holds also in alkaline waters, for pyrrhotite treated with alkaline carbonate, alkaline silicate, etc., yields alkaline sulphides much more rapidly than pyrite or chalcopyrite. Thus, in ore containing abundant pyrrhotite, the secondary sulphide zone, although it might be richer, would not extend to such great depths as it does in ores composed of pyrite and chalcopyrite and little or no pyrrhotite.

PERSONAL AND GENERAL

Mr. J. W. Astley is in Vancouver, B. C., on a business trip.

Mr. G. G. Gibbins has returned to Vancouver from Haileybury and will be this summer in charge of a party in N. W. Canada.

Mr. R. B. Lamb, consulting engineer, and Mr. G. F. Morrison, secretary of the Peterson Lake Mining Company, have returned from a trip to England on the business of the company.

At the New York Convention of the American Chemical Society, held in New York April 16, Mr. Robert Turnbull, of Welland, Ontario, presented a paper on "The Thury Electric Furnace Regulator."

Mr. H. H. Johnson is at the Tough-Oakes Mine, Kirkland Lake.

Mr. A. E. Formis has been appointed Superintendent of the Bates Mine, Iron River, Mich.

Mr. Andrew W. Baxter, formerly of Lethbridge, Alberta, is now at the Extension Colliery of the Canadian Collieries (Dunsmuir) Limited, Vancouver Island, B. C.

Mr. W. Buchanan, Superintendent of the Yankee Girl Mine, has returned to Ymir, B. C., from a week's visit to Spokane, Washington, in which city is the head office of the company working that mine under option of purchase.

Mr. Herbert Carmichael, who some time ago voluntarily retired from the position of Provincial Assayer for British Columbia, after 20 years' service, recently returned to Victoria, B. C., having made a somewhat extended stay in Ireland.

Mr. Patrick Clark, of Spokane, Washington, prominent for many years as a mining operator in the Northwest, both in the United States and across the International Boundary line in Kootenay and Boundary districts of British Columbia, was at the Standard silver-lead mine, near Silverton, B. C., during the latter part of April.

Mr. W. J. Elmendorf, of Stewart, B. C., general manager for the Portland Canal Tunnels, Ltd., made a trip to Seattle, Washington, recently, to accompany Mrs. Elmendorf north to spend the summer with him in Portland Canal district.

Mr. James Findlay, formerly manager of the Sullivan Mine, in Fort Steele mining division, East Kootenay, B. C., but latterly manager of the Maple Leaf Coal Mine, in the Blairmore-Frank district, Southwest Alberta, recently resigned.

Mr. Samuel S. Fowler, of Riondel, Kootenay Lake, B. C., has been nominated for election as chairman of the Western Branch of the Canadian Mining Institute. Mr. Fowler, who for several recent years has been general manager for the new Canadian Metal Co., operating the Bluebell Lead Mine (discovered by Douglas, a Scottish botanist, in 1825), was a councillor of the Institute in 1898 and 1899 and president in 1900.

Mr. Chas. Hussey, of Spokane, Washington, one of the executive officials of the Standard Silver-Lead Mining Co., late in April spent several days at the company's mine and concentrating mill near Silverton, B. C.

Mr. Walter Renton Ingalls, of New York City, editor of The Engineering and Mining Journal, was at Nelson, B. C., four or five days about the middle of April.

Mr. Oscar Lachmund, general manager for the British Columbia Copper Co., has returned to Greenwood, Boundary district, B. C., after having been at the company's head office, in New York City, for a short time.

Mr. Frank E. Lathe, chief chemist for the Granby Consolidated M. S. and P. Co., at its smeltery at Grand Forks, B. C., has been spending a fortnight's vacation at Anaconda, Montana.

Mr. Paul Lincoln, who lately arrived in British Columbia from Chihuahua, Mexico, has been making an examination of the Coronation Gold Mine, on Cadwallader Creek, Bridge River, Lillooet district, B. C., for the chief owners, who are moneyed men of Victoria, B. C.

Mr. J. Ralph Lockard, who was for some time general superintendent of the Comox Mines of the Canadian Collieries (Dunsmuir) Limited, is now general manager of that company, following Mr. W. L. Coulson, who resigned several months ago.

Mr. Arthur Lockwood is returning to the B. C. Oil and Coal Development Co.'s property, on Sage Creek, Flathead Valley, in the extreme Southeastern part of British Columbia, to supervise putting down a larger and deeper well than any bore heretofore made by the company, latest developments having caused the directors to undertake a further expenditure of money in proving the existence of oil there in commercial quantity. Mr. Lockwood has been in Victoria conferring with the directors relative to future operations.

Mr. Frank W. Maclennan (B. Sc. McGill 1898 and 1900) who some time ago was generel superintendent for the mining company of that name at Cerro de Pasco, Peru, is now assistant manager in charge of mining at the Miami Mine, Arizona.

The first appointment to the faculty of the new University of British Columbia, the president of which is Dr. F. F. Wesbrook, late of the University of Minnesota, has been announced by the Board of Governors. It is of Douglas McIntosh, B. A., B. Sc., (Dalhousie, N. S.); (Cornell); D. Sc., (McGill); F. R. S., Can., as associate professor of chemistry and acting head of the department. Dr. McIntosh began his work as a university teacher in 1901, when he was appointed demonstrator in chemistry at McGill University, Montreal. He became lecturer in 1905, assistant professor in 1907, and associate professor in 1909, which last-mentioned office he now fills and will continue to do so for some time longer.

Mr. D. W. McNabb, inspector for the International Bureau of Explosives, was at Fernie, Crows Nest Pass, B. C., during the latter part of April.

Mr. Alex. Sclater, of Los Angeles, California, general manager of the Union Oil Co., has been on a business visit to the Coast cities of British Columbia.

Mr. G. B. Wilson, manager of the Marblehead Quarries, eight miles up the railway from Lardo, at the head of Kootenay Lake, B. C., has returned from the United States, and is now directing the quarrying and finishing of a lot of marble for shipment to various places.

Fraser & Chalmers, of Canada, Limited, Montreal, have been awarded a contract by the Nova Scotia Steel & Coal Company, Limited, for a 2,000 kilowatt steam turbine, direct connected to an alternator of Vickers manufacture.

The Buffalo Foundry & Machine Co., of Buffalo, N. Y., announces that they have terminated the arrangement whereby Mr. H. E. Jacoby has been representing them in New York City. They are now handling direct all inquiries covering vacuum apparatus, castings, patterns, and machine work.

OBITUARY

Mr. A. B. Willmott died Friday, May 8, after a long illness. For some time he had been gradually getting weaker and finally was reluctantly forced to discontinue his professional work. A few days later he passed away.

THE LATE A. B. WILLMOTT

The late Mr. Willmott was in his forty-eighth year, and had been connected with various mining interests since his graduation from the University of Toronto in 1887.

Mr. Willmott was especially interested in the iron ore industry, and was for some time manager of mines for the Clergue interests at Sault Ste. Marie. After the re-organization of the Clergue companies, Mr. Willmott settled in Toronto and developed a practice as consulting engineer.

He is survived by a widow, one son, Roy, a daughter, Eleanor, and his father, Rev. J. C. Willmott, Milton, Ont., to them the mining men of Canada extend their sympathy.

Colin A. Campbell, assistant electrician at the Granby Consolidated Co.'s big copper mines at Phoenix, Boundary district, B. C., died in the local hospital on April 20, following an operation for appendicitis. He had been in the company's employ at Phoenix for ten years. He was born at Glencoe, Nova Scotia, 35 years ago. He leaves a widow and three children.

James H. Trafford, who died recently at Rossland, B. C., had been in that mining camp for 13 years. He was head hoist engineer at the Consolidated Mining and Smelting Co.'s Centre Star Mine and had charge there of the Nordberg hoist, which is the largest hoisting engine in British Columbia. His mother and other near relatives live at Le Mars, Iowa, U. S. A.

The Canadian Westinghouse Company has issued a bulletin on watt hour meters.

We have just received from the Herbert Morris Crane & Hoist Company, Limited, a copy of the newly issued bulletin B5, which is entirely devoted to the various types of traveling trolleys made by that company. These Morris trolleys are of many patterns to run either on a flat-bar track, or on the lower flange of an ordinary steel I beam. Some of them are prepared for short straight runways, while others, containing suitable swivels, are flexible in a horizontal direction, and thus permit of the use of curves or "bends" in the track. The bulletin contains a great deal of practical information of immediate interest to all users of this kind of equipment. The illustrations, diagrams and tables of dimensions and prices are arranged in a handy and useful form.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

According to newspaper reports, the Standard Silver-Lead Mining Co. last month declared an extra dividend, which will make $100,000 the total distribution among shareholders in either April or May. Assuming that the regular monthly dividend was declared payable on May 10, the grand total of dividend since a beginning was made by a payment of $25,000 in April, 1912, is now $1,375,000 on capitalization of $2,000,000.

News from Nelson at the end of April was to the effect that the experiments in the electric smelting of lead-zinc ores that have been carried on at that place during several recent months, have been discontinued by the Mines Branch of the Canada Department of Mines; also that prominent local residents are endeavoring to induce Mr. W. McA. Johnson, of Hartford, Connecticut, who has been experimenting in electric zinc-lead smelting for a number of years, to give his attention to Kootenay ores and to operate his continuous electric zinc furnace at Nelson. Doubtless the Provincial Government, into whose possession the zinc smeltery at Nelson has passed, will readily do anything in reason to facilitate experiments by Mr. Johnson and his associates, or anyone else whose bona fides and financial standing would entitle him to be shown such consideration.

Slocan and Slocan Lake.

The deep level adit being driven on the Noonday, near Cody, is now in about 150 ft.

Mr. Alex. Ferguson, who holds on lease the Coronation claim, on Silver mountain, above New Denver, is preparing to resume work.

Mr. W. R. Will has returned to New Denver after having spent the winter in Ontario, and is about to commence the season's work on his Capella property, on Goat mountain.

Slocan Star.—Ore has been found in the east crosscut from No. 10 level on the Slocan Star mine at 700 ft. from the main adit. The vein has been drifted on for 50 ft., and there is 3 ft. of concentrating ore. Finding ore there proves that there is stoping ground from No. 10 up to No. 8 level, 200 ft. above. The west drift from the deep level adit is also in ore.

Other properties in Slocan on which work was done in the winter are the Richmond-Eureka and Ruth, near Sandon; the Payne and Rambler-Cariboo, east of that town; the Noble Five and Surprise, above Cody; and the Cinderella and Lone Bachelor, near Three Forks. With the exception of the Payne and Noble Five, which are doing deep development work, all shipped ore during recent months.

The first car of ore shipped from the Lucky Thought, on Four-mile creek, to Trail, has been reported to have given returns as follows: Silver, 120.8 oz. to the ton; lead, 46.8 per cent.; zinc, 17.5 per cent. This is the first return from ore in quantity from this property,

which is owned by Thos. J. Lloyd, and is being worked by the Consolidated Mining and Smelting Co. under option of purchase.

The Standard Silver-Lead Mining Co. has donated to the University of Alberta, Edmonton, an excellent and representative set of mineral and rock specimens from its Standard mine, which is now the largest producer of ore in Slocan district. Mr. Wm. Thomlinson, ore sampler at the mine, selected and prepared the specimens, which include various kinds of silver bearing galena, zinc-blende and milling ores, characteristic of this mine; also specimens of gangue minerals, altered wall rocks, enclosing sedimentary rocks, and the dike rock found in or near the ore-bearing fissure.

Shipments of silver-lead ore and concentrate from the Standard mine and concentrating mill, near Silverton, Slocan lake, during four months to the end of April, have totalled approximately 5,000 tons. Beside this silver lead product, which was shipped to the Consolidated Mining and Smelting Co.'s smeltery at Trail, silver-zinc concentrate has been sent to Bartlesville, Oklahoma. There is still much ore available in the mine, the quantity in the big stope between levels Nos. 4 and 5 being large, including a shoot of fine looking galena that runs high in silver and lead. No. 7 adit is now in more than 3,000 ft. from its portal, with fully 1,000 ft. more to be driven before the face of this working will be under the productive ore shoot occurring in No. 6 level, and on up to Nos. 5 and 4. No. 8 level is being driven, and this working has already opened some zinc ore, but the adit will have to be advanced the greater part of a mile before its face will be in the silver-lead zone opened in the levels above.

The Van-Roi Mining Co. has sent out from its office in London, England, the cabled report for the month of March received from the managers of its silver-lead-zinc mine and concentrating mill in Silverton camp. The mill report shows that the total quantity of ore crushed during the month was 2,445 tons of an average assay of silver 19.3 oz. to the ton, lead 3.1 per cent., and zinc 5 per cent. This yielded 10 tons of picked ore averaging 300 oz. silver to the ton, 52 per cent. lead, and 12 per cent. zinc; 120 tons of lead concentrate assaying 231.3 oz. silver to the ton, 51.2 per cent. lead and 13.4 per cent. zinc; and 105 tons zinc concentrate assaying 83 oz. silver to the ton, 3.5 per cent. lead, and 37 per cent. zinc. The mill was operated 582 hours. The total approximate value of the products was $21,889. The expenditure during the month was: On development $3,541, ore production $9,077, milling, $3,660, and capital and other expenditure $1,545; total, $17,823. These figures compare with two previous months, thus: January, total value of products, $18,329; expenditure, $14,194. February, total value of products, $15,776; expenditure, $12,729. The balance of value of products over expenditure for the three months ended March 31 was $11,248. There was done in March 241 ft. of development work. In one raise the average value of 36 in. of ore for a length of 30 ft. was silver 42 oz. to the ton, lead 5.5 per cent., and zinc 27 per cent.; while in a drift above level No. 5, along 21 ft. advanced, 11 in. of ore averaged 150 oz. silver to the ton, 18 per cent. lead, and 13 per cent. zinc.

Tete Jaune Cache.

Mica claims in the neighborhood of Tete Jaune Cache are expected to receive more attention next summer than they have had in past years. It is known that 27 claims have been staked; some of these are owned by New York men, others in New Brunswick, and still others in Calgary, Alberta. The claims are situated on McLennan river, Sand creek, and Mica or Swanson creek, tributaries of Fraser river flowing from the south. For more than 20 years it has been known that mica occurs in this neighborhood, but as the outlet from the district was via Kamloops, the nearest accessible railway point, distant fully 300 miles, and much of it by pack trail, transportation costs were too high to allow of mining on a commercial basis being undertaken. Now, however, the construction of the Grand Trunk Pacific Railway through the district has changed conditions, so that the cost of bringing in supplies and machinery and taking out mineral is not prohibitory.

Official information relative to mica published by the Provincial Department of Mines, includes the following: Sand creek flows from the west and empties into Fraser river about one mile west of Tete Jaune Cache. The sand in this creek was found to be exceedingly micaceous; in fact, all the surface wash in this neighborhood is highly impregnated with mica. Ascending Sand creek in a south-westerly direction, it was found that the creek had cut deeply through the surface wash, leaving precipitous banks, and, at 7 miles from Fraser river, flows through a rocky canyon, with the McLennan range and Mica mountain to the south. At about 1,000 ft. elevation above the creek, on the south side, some claims have been staked, but the mica is reported to be of poor quality. Rising abruptly from Sand creek is the McLennan range, which is a high mountain-ridge running south-west and north-east, having peaks 8,500 ft. high, or 5,500 ft. above Fraser river; a continuation of this range to the east is called Mica mountain. Some of the best mica showings are reported to be on this mountain at an altitude of 8,300 ft. The claims have been located on a series of pegmatite dikes, from 3 to 10 ft. wide, in which mica has been formed in small pockets. Mica sheets, 8 x 10 in., have been taken out. South-east of the McLennan range and one mile and a half distant is Nigger Head mountain, where 12 mica claims have been taken up on a pegmatite dike 30 ft. wide and fairly well exposed by a series of open cuts; plates 8 x 10 x 3 in. of clear muscovite mica are reported to have been obtained. The altitude of the claim is more than 8,000 ft. A few miles south-east of Nigger Head mountain is Cranberry lake, in which Canoe river takes its rise, flowing southeast to the Columbia river. Occurrences of mica are reported from the headwaters of Canoe river. Opposite the McLennan range, and three miles north of Sand creek on a range of mountains, the Kelly group of mica claims has been staked, but no information could be obtained about them. It would appear that the pegmatite dikes referred to occur over a fairly wide area.

Portland Canal.

At the beginning of April the main crosscut adit of the Portland Canal Tunnels, Ltd., was in 3,010 ft. from its portal, and was being advanced in argillites with some quartz. The object of its extension is to reach the Green vein, which the company's general manager, Mr. W. J. Elmendorf, believes to be the footwall vein of what is known locally as the "fissure zone." It was from this vein, which at the surface on the O. K. Fraction claim, shows strongly on both sides of Glacier creek, that ore giving comparatively high assay returns in gold and silver was taken. The largest exposure is in the crosscut adit of the Stewart mine, 1,000 ft. above Glacier creek, where it was drifted on

for 350 ft., and was found to be more than 20 ft. wide, almost all quartz, but generally completely leached out. Where not deprived of its mineralization by leaching, stringers of ore showed high value, samples assaying gold 1.9 oz. and silver 264.1 oz. to the ton. As the depth of the low level adit now being driven is approximately 700 ft. below the surface, there is little likelihood of leaching having taken place so deep as that. The distance yet to be driven is estimated at 250 to 400 ft., according to the dip of the vein, which is not known—if 60 deg. then 400 ft., but if only 55 deg. about 250 ft. At present, ventilation not being good, only one shift is employed at the face of the main adit. Two shifts are driving about 4 ft. a day in the Lucky Boy drift on No. 1 vein, in which is the most promising showing yet found to the north of the main crosscut. Scattered mineralization occurs throughout this drift, and in one part there was exposed 6 in. of solid galena and pyrite of fair grade. Further extension of this drift will be the shortest course to ore known to exist in the property of the Glacier Creek Mining Co. and of the Stewart Mining and Development Co. No work is being done at present in the Melba drift, which extends 238 ft. south from the main crosscut, on No. 2 vein, into the Melba claim, owned by the Tunnels Co. This vein is remarkably strong and regular, is about 40 ft. wide, and consists of argillite breccia, with a large proportion of quartz and a scattered mineralization of pyrite and pyrrhotite. Apart from its lack of mineralization, this vein is the best showing in the mine, and a large ore shoot may reasonably be expected when ore shall "make" in it. The Richard drift is in the Portland Canal Mining Co.'s Richard II. claim. It is on No. 3 vein and extends 141 ft. south from the main crosscut; it shows ore all the way, and at one place there is a width of 10 in. of solid galena and pyrite lying on 30 in. of mineralized porphyry. Some chalcopyrite was found—the first in these workings and unusual in the "fissure zone." The vein is 3 to 4 ft. wide, and it persistently follows a porphyry dike. Samples of fairly clean ore from this drift assayed as follows: Selected copper ore: Gold 0.16 oz. and silver 16.6 oz. to the ton and copper 7.5 per cent. Selected lead ore: Gold 0.04 oz and silver 28.8 to the ton, and lead 46.7 per cent. The three veins—Nos. 1, 2 and 3—approach each other on their southerly course; taking the courses as now shown by the various workings, Nos. 1 and 2 will join at about 450 ft. south from the present face of the Melba drift, and No. 3 approximately 500 ft. beyond that. Generally, the outlook is regarded as encouraging, both as regards developments in the mine and for financing operations throughout the ensuing summer.

PORCUPINE, KIRKLAND LAKE AND MUNRO TOWNSHIP

Reaume.—Considerable interest has been aroused by the discovery in Reaume township, about seven miles from the Transcontinental railway and about 20 miles north of Porcupine, of an ore body containing microscopic diamonds, chrome iron ore and about $1.50 a ton in platinum. The specimen which has been submitted to a thorough examination, was taken from an ore body on Mr. O'Connor's claims. This is the first authentic discovery of diamonds in the Province, and although the diamonds are of absolutely no economic importance, it confirms the opinion that geologists have long entertained that some day economic diamonds will be found in the great and for the most part unexplored portion of Northern Ontario. The rock in which the ore was found is peridotite and weathers readily to serpentine, and is widespread and near the Porcupine area. There are not many exposures of rock in Reaume township, so that so far it has been considered an agricultural rather than mineral bearing township.

Ogden.—The compressor plant at the Lally gold mines in Ogden township was turned over for the first time this month. The shaft has reached a depth of 50 ft. and diamond drilling is in progress.

Vipond.—The Vipond mine is working again. A new company, to be called the Porcupine Vipond Mines, Limited, with a capitalization of $1,500,000, has been formed. Of this 750,000 shares will be issued to the old shareholders at the ratio of 8 shares of the old company for 3 shares of the new. Of the remainder of the stock 450,000 shares will be left in the treasury and 300,000 will be offered to present shareholders.

Dome.—The extension to the Dome mill will be completed by the end of the present month, and the 80 stamps should be dropping. The main shaft is now down 90 ft. below the 424 ft. level, and will be carried down to 525 ft. before a station is cut. Costs, which are now running between $3 and $3.50 a ton, will be cut down materially when the addition to the present mill is in operation.

COBALT, GOWGANDA, SOUTH LORRAIN

Crown Reserve.—The decision of the Privy Council in London last week settled finally a famous law suit, which has engaged the attention of Crown Reserve shareholders for six years, or since the Crown Reserve showed any promise of developing into a mine. The suit was brought by several original members of the syndicate, among them Messrs. Fowler, Ross, John Black and others, to recover 231,000 shares of Crown Reserve stock. As altogether $70,000 had been paid in dividends upon these shares, the suit was one of considerable dimensions. It has been fought from court to court in Canada, and was finally taken over the seas, where the decisions of the Canadian courts were ratified by the conclusion that the plaintiffs had failed to make good their case against the Crown Reserve Mining Company. The plaintiffs will also have to pay the heavy costs of the proceedings.

Coniagas.—The Coniagas Mining Co. has received permission from the town of Cobalt to run a trestle across Silver street, so that they may dump rock from a shaft in the centre of the town on to some land rendered vacant by a recent fire. The matter has aroused a good deal of interest, owing to the fact that the proposed location of the shaft is right in the centre of the town, and the rock will have to be dumped on to ground already occupied by various dwellings. The proposed shaft, which was sunk to the 50 ft. level about three years ago, is on the west side of Silver street, and it is proposed to carry the rock over to the other side, where it will not cause so much damage to existing property. The intention and aim of the work from the new shaft is to explore the ground under this portion of the town, and with the specific intention of cutting the vein or veins found on the City of Cobalt near the Coniagas boundary.

Peterson Lake Mining Co. has declared its maiden dividend of 1¾ per cent., payable quarterly, or 7 per cent. a year. On the outstanding capital of the company this will amount to $42,032 a quarter, or $168,128 a year, an amount which the Peterson Lake should

have no difficulty in meeting. Another shoot has been picked up by the company in their drift at the 200 ft. level of their Kerry lease on Peterson Lake. After being drifted upon for about 110 ft. the vein went out of the drift and could not be picked up again, so the original drift was continued ahead. About 31 ft. from the point where the vein was lost, it has again been picked up, and appears to be as good as ever.

A high grade car of ore will be shipped early this month. At the other shaft of the company, near the narrows between the two lakes, development is being continued with great vigor, but so far without any tangible result.

Chambers-Ferland.—After a very stormy meeting the by-law confirming the transfer of Chambers-Ferland stock to Alladin Cobalt stock at a ratio of 20 to 1, was left over for final ratification until the annual meeting on June 10. The meeting was held in Cobalt, and a vigorous opposition developed from minority shareholders of the Chambers Ferland, who were represented by Mr. A. A. Amos, of the firm of Vickery & Amos, of Toronto. It was known before the meeting was held that Captain Jorgenson, president of the Alladin Cobalt, held two-thirds of the stock for himself and his English associates, and could force the by-law through if he so wished. It also transpired that in addition to the control he had purchased from individual shareholders, he had proxies from 300 shareholders of Chambers-Ferland stock, which had not been transferred to the Alladin Cobalt. The opposition protested against the transfer, that the ratio of exchange, 20 to 1, was altogether too high for the relative value of the properties held by the two companies. Mr. Amos said that the lease on the Silver Queen, which was the only asset the Alladin Cobalt had apart from the control of the Chambers-Ferland, was worth nothing, since that property was regarded as being entirely without future. Chambers-Ferland shareholders were quite ready to develop the Chambers-Ferland property with the money in the treasury, which amounted to $140,000, and should be enough to develop the property to a paying basis. Captain Jorgenson stated that the Silver Queen had produced 70,000 oz. and 50 tons of ore a day was being milled from the workings there. If the amalgamation were effected a good market could be created in London, which was not available at present. The exchange was based on a market value of 25 cents a share for Chambers-Ferland, which was more than the stock was selling at at present. Finally, on the motion of Mr. T. R. Shillington, who supported Captain Jorgenson, it was decided to postpone the meeting until June 10th, the date set for the annual meeting, when the matter will again come up.

Cobalt Lake.—It is now definitely stated that the pumping of Cobalt lake will not be commenced until August or September. It is now anticipated that the dam on Short lake will take three months to complete, and it has been discovered that the scope of preparations for the draining is of necessity so wide that it will be impossible to actually commence the pumping of the lake until the fall. The deepening of the outlet will, however, commence almost at once, and when this is completed the water will fall from 6 to 7 ft.

Buffalo.—The March mill report of the Buffalo shows a considerable increase above the preceding month of February. The increase in the amount of silver recovered was almost 40,000 oz. The mill report for March reads: Mill ran (hours) 642, ore milled (tons) 7,015, average assay 25.43 oz., ozs. recovered 142,786, ozs. paid for 150,164.

Timiskaming.—The report of the new directorate of the Timiskaming mine makes it clear that more ore will have to be put in sight before further dividends can be thought of. Mr. Frank L. Culver, who is the new president, states that on the levels above the 400 ft. there is no ore in sight, and from the 400 ft. to the 650 ft. levels there is no actual high grade in sight, but there is enough low grade to keep the mill running and maintain current expenses. The shaft has been carried down to the 750 ft. level, where a crosscut will be made and an attempt made to pick up the known veins in the diabase formation. The company's cash balance on March 31st, was $77,173.

The Crown Reserve is this month shipping 20 tons of ore to the Kingdom of Saxony smelter, which will run 5,500 oz. to the ton. Roughly estimated, it will be worth over $50,000. Six tons of the ore was remarkable, running between 8,000 and 10,000 oz. to the ton, and was stoped from a pocket of ore found near the Carson vein on the first level.

The Otisse mine at Elk Lake has been taken over by a syndicate of shareholders, who advanced the money necessary to carry on development and who took a mortgage as security.

McKinley-Darragh.—The Bureau of Mines in Toronto has refused the application of Mr. T. R. Finucane, manager of the McKinley-Darragh Mining Co., in regard to his staking of four acres of Cart Lake. The department ruled that the four acres were included in the original sale by the Government to the Peterson Lake Silver Mining Co.

COBALT SHIPMENTS.

The ore shipments from the Cobalt camp for the week ending May 8th were abnormally high, no less than fourteen mines contributing over a million lb. The Peterson Lake Co. made its first shipment. The Chambers-Ferland also made a shipment of about 43 tons of concentrates. Although ore has gone out under the seal of the company for the past three or four years, it was all from leases.

The Crown Reserve shipped a bonanza car to Hamburg and the excellent progress of the Penn-Canadian was reflected in a high-grade shipment from the old Cobalt Central mine. The City of Cobalt, will also be in a better position financially when the high grade car shipped this week from the workings under the town has been marketed. In bullion the Nipissing alone was prominent.

The shipments from the Cobalt camp for the week ending May 8th were:

	High.	Low.	Pounds.
Trethewey	47,850	56,230	104,080
Peterson Lake	51,700	.....	51,700
Cob. Townsite	72.040	.....	72,040
McKin.-Dar.	66,090	.....	66,090
Cham.-Ferland	87,960	.....	87,960
Dom. Reduction	.....	87,000	87,000
Cobalt Lake	64,430	.....	64,430
Temiskaming	70,130	.....	70,130
City of Cobalt	77,360	.....	77,360
Crown Reserve	40,000	.....	40,000
Penn-Canadian	71,190	.....	71,190
O'Brien	61,270	.....	61,270
Nipissing	.....	76,270	76,270
Hudson Bay	.....	85,910	85,910
	710,020	304,410	1,015,430

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

May 8, 1914.

New York Curb.

	Bid.	Ask.
Alaska Gold	26.50	27.00
British Copper	1.62	1.87
Braden Copper	7.87	8.12
California Oil	300.00	304.00
Chino Copper	40.75	41.12
Giroux Copper	1.00	1.37
Green Can.	30.00	35.00
Granby	79.00	80.00
Miami Copper	21.37	21.50
Nevada Copper	13.75	14.00
Ohio Oil	170.00	172.00
Ray Cons. Copper	20.75	21.00
Standard Oil of N. Y.	212.00	214.00
Standard Oil of N. J.	410.00	413.00
Standard Oil (old)	950.00	1036.00
Standard Oil (subs)	.....	.....
Tonopah Mining	6.37	6.50
Tonopah Belmont	7.12	7.50
Tonopah Merger	.57	.59
Inspiration Copper	16.75	17.00
Goldfield Cons.	1.37	1.43
Yukon Gold	2.50	2.75

Porcupine Stocks.

	Bid.	Ask.
Apex	.02½	.03
Dome Extension	.08	.08¼
Dome Lake	.35	.36
Dome Mines	9.75	10.00
Eldorado	...	...
Foley-O'Brien	.19	.21
Hollinger	15.40	15.60
Jupiter	.10	.10½
McIntyre	.23	.24
Moneta	.02	.03
North Dome	...	.05
Northern Exploration	2.25	2.75
Pearl Lake	.06	.07
Plenaurum	.50	.60
Porcupine Gold	.08¾	.09¼
Imperial	.01¾	.02
Porcupine Reserve	...	...
Preston East Dome	.01½	.02
Rea	.10	.20
Standard	.00½	.01
Swastika	.02	.02¼
United	...	...
West Dome	.08	.10
Porcupine Crown	.80	.85
Teck Hughes	.08	.10

Cobalt Stocks.

	Bid.	Ask.
Bailey	.02¾	.02⅞
Beaver	.24	.24½
Buffalo	1.20	1.40
Canadian	.06	.08
Chambers Ferland	.15	.17
City of Cobalt	.45	.52
Cobalt Lake	.45	.50
Coniagas	7.20	7.40
Crown Reserve	1.33	1.37
Foster	.04	.06
Gifford	.02½	.03
Gould	.02	.02⅛
Great Northern	.09	.09¼
Hargraves	.01½	.02
Hudson Bay	75.00	80.00
Kerr Lake	4.35	4.50
La Rose	1.40	1.43
McKinley	.62	.65
Nipissing	6.00	6.13
Peterson Lake	.42	.42¼
Right of Way	.04	.05
Rochester	.02	.03
Leaf	.01	.02
Cochrane	.45	.55
Silver Queen	.01½	.02
Timiskaming	.13½	.14
Trethewey	.20	.25
Wettlaufer	.05	.06
Seneca Superior	2.70	3.00

TORONTO MARKETS.

May 11—(Quotations from Canada Metal Co., Toronto).
- Spelter, 5¼ cents per lb.
- Lead, 5¼ cents per lb..
- Tin, 36 cents per lb.
- Antimony, 8½ cents per lb.
- Copper, casting, 15 cents per lb.
- Electrolytic, 15 cents per lb.
- Ingot brass, 10 to 15 cents per lb.

May 11—Coal—(Quotations from Elias Rogers Co., Toronto).
- Anthracite, $7.50 per ton.
- Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

May 8.—Connellsville Coke, (f.o.b. ovens).
- Furnace coke, prompt, $1.85 to $1.95 per ton.
- Foundry coke, prompt, $2.35 to $2.50 per ton.

May 8.—Tin, straits, 33.45 cents.
- Copper, Prime Lake, 14.37½ to 14.50 cents.
- Electrolytic copper, 14.00 to 14.10 cents.
- Copper wire, 15.25 cents.
- Lead, 3.90 to 3.95 cents.
- Spelter, 5.15 to 5.25 cents.
- Sheet zinc, (f.o.b. smelter), 7.00 cents.
- Antimony, Cookson's, 7.25 to 7.35 cents.
- Aluminum, 17.75 to 18.00 cents.
- Nickel, 40.00 to 45.00 cents.
- Platinum, soft, $43.00 to $44.00 per ounce.
- Platinum, hard, 10%, $46.00 to $47.50 per ounce.
- Platinum, hard, 20%, $49.00 to $51.50 per ounce.
- Bismuth, $1.95 to $2.15 per pound.
- Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
April 25	59	27⅛
" 27	59⅛	27 3/16
" 28	59¼	27¼
" 29	59	27 3/16
" 30	59¼	27¼
May 1	59⅛	27 3/16
" 2	59⅛	27 3/16
" 4	59⅛	27 3/16
" 5	59⅛	27 3/16
" 6	59	27⅛
" 7	58¾	27
" 8	58⅞	27 1/16

Put Your Factory Equipment Needs Up to

GOODYEAR
TORONTO

Goodyear factory equipment has established a new efficiency standard in large and small manufacturing concerns throughout the Dominion.

Where "price" used to be the basis of purchase in these places, it is now *SERVICE*.

Belting now is bought on *service rendered* and *operating economy effected*. So is Hose. So are Packing and Valves. Manufacturers are buying Goodyear equipment because they know that they can get the very article for the very need—based on an actual investigation and study of the very requirement.

And in buying factory equipment this Goodyear *efficiency service* is yours without extra charge.

Belting

Transmission Belts that deliver all the power without undue strain on the pulleys and "coal pile." Each belt made to meet the very purpose for which it is designed. Each made for "pulling" power—without unnecessary bulk and weight.

"Leg" and "Bucket" Conveyor Belts. For carrying heaviest loads—coal, gravel, ore, grain, etc. Each made with the exact surface for the exact purpose. Carry the load with least wear and tear. Day in and day out utility insures real economy.

Special Brick Conveyor Belt—with oil-resisting stock face. Unaffected by oil that is shed by machine.

Tell Goodyear your belt needs. Learn beforehand of just the belt, *and why*. Then, no after regrets—no after expense.

Hose

Steam Hose, Air Drill Hose, Agricultural Hose, Hose for gas, acids, and hot and cold liquids. Each made with the special inner lining for its particular purpose. Hence, longer life—*greater service*.

Let Goodyear tell you of just the hose you need. Perhaps you have not thought much about it before. But it's a vital matter just the same, if you value time and money saving. Goodyear has already solved just such hose problems as yours.

Packing and Valves

Poor packing may serve today—and tomorrow. But it soon gives out. That means lost time—lost motion—expense.

Goodyear Packing gives you a tight joint whether the pressure is air, hot or cold water, or superheated steam. Will not blow out. Unaffected by expansion or contraction. Won't flow under intense heat or pressure.

Goodyear Valves are made for all purposes—from cold water to acids—low pressure and high pressure, air and steam. We will tell you the "why" of just the Goodyear packing and valves for your every purpose.

Use This Free Service Asking questions about your belting, hose, packing and valve needs, costs you nothing—involves no obligation. The Goodyear Efficiency Bureau will be glad to confer with you at any time. Write today.

THE GOODYEAR TIRE & RUBBER COMPANY OF CANADA, LIMITED

Head Office: Toronto, Ont. **Factory: Bowmanville, Ont.**

(33)

Fairbanks Springless Dial Scales

The illustration shows Dial Attachment for Dormant Warehouse Scales.

Dial 30" in Diameter.
Graduated 1000 lbs. x 1 lb.
Auxiliary Beam, capacity 2000 lbs.
Tare Bar, 500 lbs. x 1 lb.

¶ With a Fairbanks Dial Scale You Can Decrease your Weighing Time to a Minimum.

¶ These dials are made in Canada and are specially designed for this climate. ¶ They are springless and are not affected by temperature changes. ¶ They can be attached to any Dormant Warehouse Scale and, in this day of progressive methods, should be used in every plant.

Write at once for complete information

The Canadian Fairbanks-Morse Co. Limited

Montreal St. John Quebec Ottawa Toronto Hamilton Fort William
Winnipeg Regina Saskatoon Calgary Edmonton Vancouver Victoria

Canada's Departmental House for Mechanical Goods

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.
Willmott, A. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & Deyell
Heys, Thos. & Son
Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd
Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place - New York City
General Manager
Consolidated Arizona Smelting Co.,
Humboldt, Ariz.

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

JOHN V. N. DORR
Consulting and Metallurgical Engineer
30 Church Street - New York City
and
First National Bank Building, Denver, Colorado.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

A. B. WILLMOTT

LAWYERS

Telephone Main 3813
Cable Address: "Chadwick" Toronto
Western Union Code
E. M. Chadwick, K.C
David Fasken, K.C.
M. K. Cowan, K.C.
Harper Armstrong
Alexander Fasken
Hugh E. Rose, K.C.
Geo. H. Sedgewick.
James Aitchison
Beatty, Blackstock, Fasken Cowan & Chadwick
Barristers, Solicitors, Notaries
Offices: Bank of Toronto, Cor. Wellington & Church Sts.
58 Wellington St. East
Toronto

G. G. S. Lindsey, K.C.
Telephone Main 6070
Cable Address: "Lindsey," Toronto
Codes, Broomhall, McNeil's 1908
Commissioner for taking affidavits in British Columbia.
counsel with
Gregory & Gooderham, Barristers and Solicitors, Canada Life Building, Toronto

Phone Main 2311
Cable Address "Segsworth" Toronto
R. F. SEGSWORTH
Barrister, Solicitor, Notary, Etc.
JARVIS BUILDING
103 Bay Street - TORONTO

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers
at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE
Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

WANTED—DRAUGHTSMAN familiar with Mill Work. State Experience and Salary Wanted.
Moose Mountain, Limited, Sellwood, Ont.

Mine superintendent, foreman, surveyor and assayer, with fifteen years experience, open for engagement.
Address Box 5, Can. Mining Journal, Toronto.

TO INVESTORS
I want $1,500 to fit out a prospecting expedition to carry on exploration work in the new gold field. Parties putting up the money will be entitled to a claim.
Box "A". Canadian Mining Journal

The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

Guide Books to excursions of the International Geological Congress.

1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1173. Memoir 20. Gold fields of Nova Scotia, by W. Malcolm. Map not published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1279. Memoir 25. Report on the clay and shale deposits of the Western Provinces, by Heinrich Ries and Joseph Keele.

1225. Memoir 30. The basins of Nelson and Churchill rivers, by William McInnes. Map not published.

BRITISH COLUMBIA

1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1162. Map 26A. Bathurst and vicinity, Gloucester County, New Brunswick. Topography.

1163. Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.

1300. Map 100A. Bell River, Quebec. Geology.

1301. Map 101A. St. Hilaire and Rougemont Mountains, Rouville and St. Hyacinthe Counties, Quebec. Geology.

ONTARIO

1199. Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.

1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.

1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.

1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.

1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.

1304. Map 106A. Groundhog coal field, British Columbia. Geology.

1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

1298. Map 99A. Southern portion of Cranbrook map-area, East and West Kootenay, British Columbia. Geology.

YUKON and NORTH WEST TERRITORIES

1332. Map 113A. Canadian routes to White River district, Yukon, and to Chisana district, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BOILERS

"INGLIS" STANDARD RETURN TUBULAR BOILER

We make Boilers of all kinds for any service.

For Fifty-two (52) years our boilers have been recognized as the Canadian Standard because they combine all the essentials requisite to produce the best boiler.

Is is a pleasure for us to show prospective buyers our different types of boilers in operation.

WRITE US FOR PRICES AND SPECIFICATIONS

The John Inglis Co.,
LIMITED

Engineers and Boilermakers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL. 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office: 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,
21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores
Manufacturers of
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

Balbach Smelting and Refining Co. Newark, N. J.

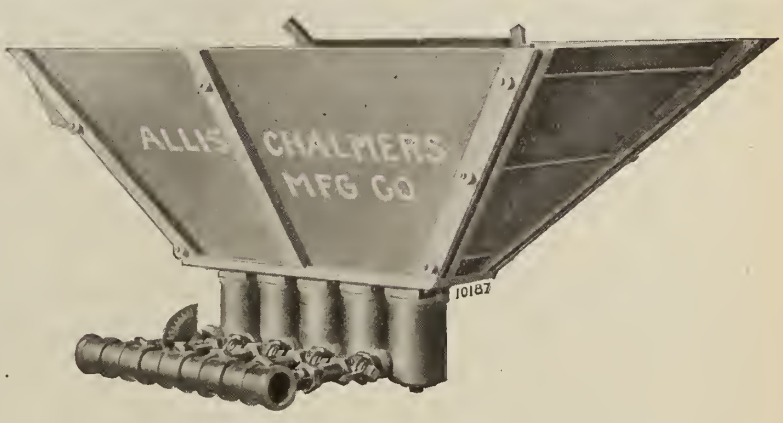
Buyers of
Gold, Silver, Lead and Copper Ores.
Lead Residues and Copper Residues.

Electrolytic Copper Refinery

INQUIRIES SOLICITED

RICHARDS' HINDERED SETTLING

The greatest advance in the art of concentration within the past decade has been the recognition of the principles of Hindered Settling. Our bulletin, 1806, describes fully Richard's Hindered Classifier, and is well worth your attention.



CANADIAN ALLIS-CHALMERS, LIMITED

Head Office - - TORONTO

District Sales Offices: MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER. PRINCE RUPERT

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFER IOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

When answering Advertisements please mention THE CANADIAN MINING JOURNAL.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co. 2
American Diamond Rock Drill Co. 16
Astley, J. W. 23

B

Balbach Smelting & Refining Co.. 28
Bartlett, C. O., & Snow Co. 17
Bath, Henry & Son 28
Beatty, Blackstock, Fasken, Cowan & Chadwick 24
Beatty, M. & Sons, Ltd. 11
Belleville Assay Office 25
Bennett, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons 16
Blackwell, Geo. G., Sons & Co. ... 28
British Columbia, Province of ... 18
Brown & Butters 23
Burchell, Geo. B. 23
A. M. Byers Co .....
.....inside front cover

C

Can. H. W. Johns-Manville Co., Ltd. 9
Canadian Allis-Chalmers, Limited.. 29
Campbell & Deyell 25
Canadian Cleveland Drill Co 9
Canadian Copper Co. 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22
Canadian Laboratories, Ltd. 25
Canadian Northern Steamships ... 6
Canadian Ingersoll-Rand Co., Ltd... 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith 23
Cohen, S. W. 23
Colvocoresses, G. M. 23
Consolidated Mining & Smelting Co 28
Coniagas Reduction Co., Ltd. 28
Curtis's & Harvey .....
.....Outside back cover

D

Dept. of Mines, Canada 26
Deloro Mining & Reduction Co... 28
DePencier, H. P. 23
Diamond Drill Contracting Co..... 16
Dominion Coal Co., Ltd. 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co. 16
Donald, Dr. J. T. 25
Dorr, Jno. V. N. 24
Drury, H. A. Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Electric Steel & Metals Co., Ltd. .. 8
Evans, J. W. 23

F

Ferrier, W. F. 23
Fleck, Alex. 6
Flory, S., Mfg. Co. 12
Forbes, D. L. H. 23
Fowler, S. S. 23
Fraser & Chalmers of Can., Ltd.... 4
Federal Engineering Co., Ltd. 31

G

Goodyear Tire & Rubber Co. of Can. Ltd. 21
Graham, S. N. 23
Gray, John 25
Greening, B., Wire Co., Ltd. 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John 24
Hardman, J. E. 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd. 25
Heys, Thos. & Son 25
Hille, F. 24
Holman Drill Co. 20

I

Inglis, John & Co., Ltd. 27
Imperial Bank of Canada 11
Industrial & Technical Press, Ltd.. 13
International Nickel Co. 8

J

James Ore Concentrator Co. .....
.....Outside back cover
Johnson, W. S. 24
Jones & Glassco 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co. 25
Loring, F. C. 24
Lymans, Limited 9
Lands of the Algoma Central and Hudson Bay Ry. 36
Lindsey, G. G. S. 24

M

Merrill Metallurgical Co. 5
Herbert Morris Crane & Hoist Co., Ltd. 16
Morton, B. K. & Co. 18
McEvoy, James 24
Mussens, Limited .....
.....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co. 10
Nova Scotia, Province of 15
Northern Canada Supply Co., Ltd. 6

O

Orford Copper Co. 8
Ontario, Province of 30

P

Peacock Bros. 7
Pickings, H. B. 24
Pyke, James W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd. 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Segsworth, W. E. 24
Siemens Co., of Canada Ltd. 35
Smart-Turner Machine Co. 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd. .....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Sullivan Machinery Co. 2
Summerhayes, Maurice W. 24
Swedish Steel & Importing Co., Ltd. 12

T

Geo. Taylor Hardware Co., Ltd.... 4
Timiskaming & Northern Ont. Ry. 19
Tyrrell, J. B. 24

W

Willmott, A. B. 24
Walker Bros. 7

TEON BELTING

Teon Belting is made for special conditions. It will stand a temperature as high as 250° Fahrenheit. It will stand the action of most acids and alkali.

For conveying hot materials it is furnished with an asbestos face.

Write for our new book giving valuable information on Belting.

FEDERAL ENGINEERING CO'Y. LTD.

TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Amalgamations—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd.
Peacock Bros.
Geo. Taylor Hardware Co, Ltd

Bags—
Smart-Woods, Ltd.

Ball Mills—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Canadian Fairbanks-Morse Co., Ltd.
Federal Engineering Co., Ltd.
G. Taylor Hardware Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd
Curtis & Harvey (Canada), Limited.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Blowers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Boilers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Waterous Engine Works Co., Ltd.
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
The John Inglis Co., Ltd.

Buckets—
Rock & Power Mach'y, Ltd.
Peacock Bros.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd

Cable — Aerial and Underground—
G. Taylor Hardware Co., Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.
G. Taylor Hardware Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Cement Machinery—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Chain Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell
Thos. Heys & Son
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Handling Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Compressors—Air—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd
Laurie & Lamb
Canadian Westinghouse
Can. Ingersoll-Rand Co. Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Canadian Fairbanks-Morse Co.

Concrete Mixers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Condensers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co., Ltd.
Peacock Bros.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Waterous Engine Works

Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Post Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith
B. Greening Wire Co., Ltd.
G. Taylor Hardware Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Lymans, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roessler & Hasslacher
Thos. & Wm. Smith
Peacock Bros.

Derricks—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Drills—Core—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Can. Ingersoll-Rand Co., Ltd

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Ltd.
Orenstein-Arthur Koppel Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Elevators—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Peacock Bros.

Engineering Instruments—
C. L. Berger & Sons
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Mussens, Ltd.
Alex. Fleck
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
M. Beatty & Sons
Canadian Westinghouse
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Engines—Oil—
Rock & Power Mach'y, Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.

Engines—Steam—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons
Laurie & Lamb
Mussens, Ltd.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Filters—
Krupp, Fried, A. G., Germany

Friction Hoists—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.

Forgings—
M. Beatty & Sons
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Bros.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :	Halifax
QUEBEC :	Montreal
ONTARIO : Toronto, Cobalt, South Porcupine, Port Arthur,	Kingston
MANITOBA :	Winnipeg
ALBERTA :	Edmonton
BRITISH COLUMBIA : Vancouver, Victoria, Nelson,	Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krup, Fried. A. G., Germany
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey, (Canada), Limited
Canadian Westinghouse
Canadian Explosives
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Gears—
Canadian Westinghouse
Krupp, Fried. A G., Germany
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse
Northern Electric Co., Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Heaters—Feed Water—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Laurie & Lamb
Canadian Westinghouse
Peacock Bros.
Fraser & Chalmers, Ltd.
G. Taylor Hardware Co., Ltd.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air Electric and Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
S. Flory Mfg. Co.
Jones & Glassco
Waterous Engine Works
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting Engines—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Cleveland Drill Co.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Jacks—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives
Peacock Bros.
Ackroyd & Best
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works
Northern Canada Supply Co.
Jones & Glassco

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.
Canadian Westinghouse
Siemens Co. of Canada, Ltd.

Locomotives—Steam—
Mussens, Ltd.
Canadian Westinghouse

Metal Merchants—
Henry Bath & Son
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Northern Electric Co., Ltd.
Can. Fairbanks-Morse Co.
G. Taylor Hardware Co., Ltd.
Canadian Westinghouse
Peacock Bros.
Siemens Co. of Canada, Ltd.

Ore Sacks—
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Ore Testing Works—
Ledoux & Co.
Can. Laboratories
Milton Hersey Co., Ltd.
Campbell & Deyell

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada
Krupp, Fried, A. G., Germany
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Thos. & Wm. Smith
Peacock Bros.

Pipes—
Consolidated M. & S. Co.
Peacock Bros.
G. Taylor Hardware Co., Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Canadian Westinghouse
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Pneumatio Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatio Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
G. Taylor Hardware Co., Ltd.
Jones & Glassco

Producer—Gas—
Krupp, Fried, A. G., Germany
Mussens, Ltd.

Prospecting Mills and Machinery—
Rock & Power Mach'y, Ltd.
Standard Diamond Drill Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
G. Taylor Hardware Co., Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Laurie & Lamb
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Rock & Power Mach'y, Ltd.
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Jeffrey Mfg. Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumatic—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Can. Ingersoll Rand Co., Ltd.

Pumps—Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co. Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
G. Taylor Hardware Co., Ltd.
The John Inglis Co., Ltd.

Pumps—Turbine—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Rock & Power Mach'y, Ltd.
Can. Cleveland Drill Co.
Krupp, Fried. A. G., Germany
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany

Rolls—Crushing—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Can. Allis-Chalmers, Ltd.

Roofing—
Paterson Mfg. Co.
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville Co.
Geo. Taylor Hardware Co,Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.
G. Taylor Hardware Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany
Thos. Heys & Son

Screens—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
R. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.

Separators—
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
M. Beatty & Sons

Slime Tables—
Deister Concentrator Co.
James Ore Concentrator
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Smelting Machinery—
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.

Stamp Mills—
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drills—
Rock & Power Mach'y, Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A G., Germany
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd
G. Taylor Hardware Co., Ltd.

Steel—Tool—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley
C. L. Berger

Switchboards—
Canadian Westinghouse
Can. Allis-Chalmers, Ltd.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Tanks—Cyanide, Etc.—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.

Transformers—
Canadian Westinghouse
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Peacock Bros.
Siemens Co. of Canada, Ltd.

Transits—
C. L. Berger & Sons
W. F. Stanley
Peacock Bros.

Tractors—Oil—
Can. Fairbanks-Morse Co., Ltd.

Tube Mills—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.

Turbines—
Rock & Power Mach'y, Ltd.
Canadian Westinghouse
Peacock Bros.
Laurie & Lamb
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Winding Engines—
Rock & Power Mach'y, Ltd.
Waterous Engine Works
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Wire Cloth—
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co.

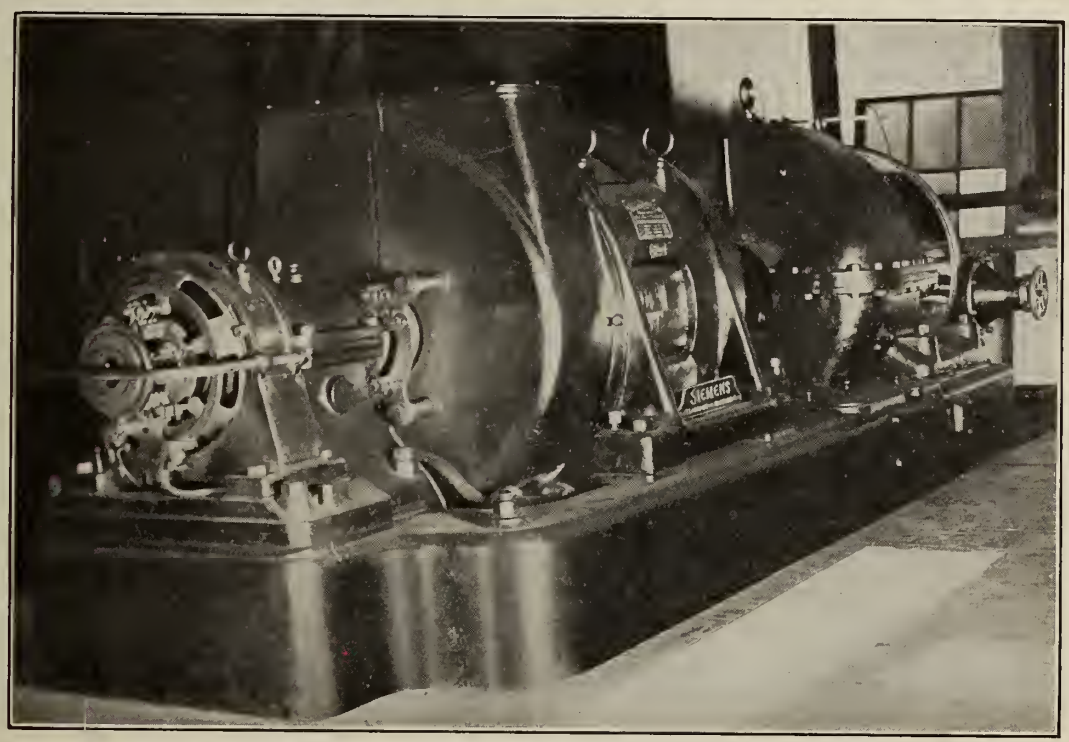
Wire (Bare and Insulated)—
Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS—SCHUCKERT | SIEMENS & HALSKE



Siemens 750 K.W., 3,600 R.P.M. Turbo Generator supplied to the Nova Scotia Steel and Coal Company, Nova Scotia.

The following Siemens **Turbo Generators** have been supplied or are on order for Canada.

1—4000 K.W. Edmonton.
1—3000 K.W. Regina.
1—2500 K.W. Dominion Coal Co.
1—2000 K.W. Dawson City
1—2000 K.W. Dawson City.
1—2000 K.W. Dawson City.
1—2000 K.W. Edmonton.
1—1500 K.W. Regina.
1—1500 K.W. Moose Jaw.
1—1500 K.W. Regina.
1—1200 K.W. Lethbridge.
1— 750 K.W. Nova Scotia Steel & Coal Co.
1— 675 K.W. Medicine Hat.
1— 675 K.W. Medicine Hat.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Wayagamack Pulp & Paper Co.

The Siemens Companies undertake the complete electrical equipment of Mines, Power Houses and Transformer Stations.

Siemens Company of Canada, Limited

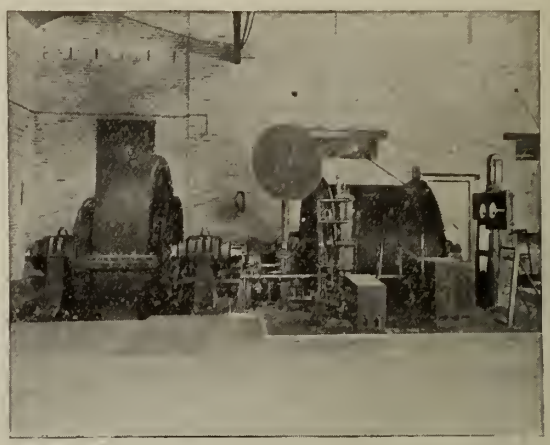
HEAD OFFICE
TRANSPORTATION BUILDING - MONTREAL

BRANCH OFFICES:

STANDARD BANK BUIDING
TORONTO

McARTHUR BUID ING
WINNIPEG

Westinghouse Motors and Control, designed especially for electric mine hoist installations, have embodied in their design features that ensure the following:



Westinghouse Motor Driving Large Mine Hoist

Maximum Output Under All Conditions. Liberal design of motors makes it possible to hoist increased loads for a long period to make up for time lost in delivering coal or ore, to the foot of the shaft.

Reliability. Reliability means continuity of service, assuring against loss due to reduced output caused by motor or control trouble.

Ruggedness. The first two points are dependent upon ruggedness of mechanical and electrical construction.

Efficiency. Power consumption per ton output is an important factor. Westinghouse high efficiency means low operating costs.

Safety. All Westinghouse hoisting installations are designed with control arranged to prevent accidents due to overwind, failure of power and errors in judgment of the operator.

Our specialists in mining equipment will be glad to assist you in selecting the proper equipment for your mines. Their services are at your disposal if you will write to the nearest office listed here.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO	MONTREAL	OTTAWA	HALIFAX	WINNIPEG	CALGARY	VANCOUVER
Traders Bank Bldg.	52 Victoria Sq.	Ahern & Soper, Ltd.	Telephone Bldg.	158 Portage Ave. E.	Grain Exchange Bldg.	Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

—— *FOR REGULATIONS, MAPS, ETC., APPLY TO* ——

JOHN A. DRESSER,

Manager, Lands Dept., A. C. & H. B. Ry.,

Sault Ste. Marie, Canada

THE

JOURNAL OF COMMERCE

With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M.A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

—— *Published by* ——

THE INDUSTRIAL & EDUCATIONAL PRESS, Limited

35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto

—— *which also publishes* ——

CANADIAN MINING JOURNAL — *Editor: Reginald E. Hore, B.A.*

CANADIAN TEXTILE JOURNAL — *Editor: E. Stanley Bates*

PULP AND PAPER MAGAZINE OF CANADA — *Editor: A. Gordon McIntyre, B.A., B.Sc.*

CANADIAN MILLER AND CEREALIST — *Editor: J. G. Adams, B.A.*

CANADIAN FISHERMAN — *Editor; F. Wm. Wallace*

These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

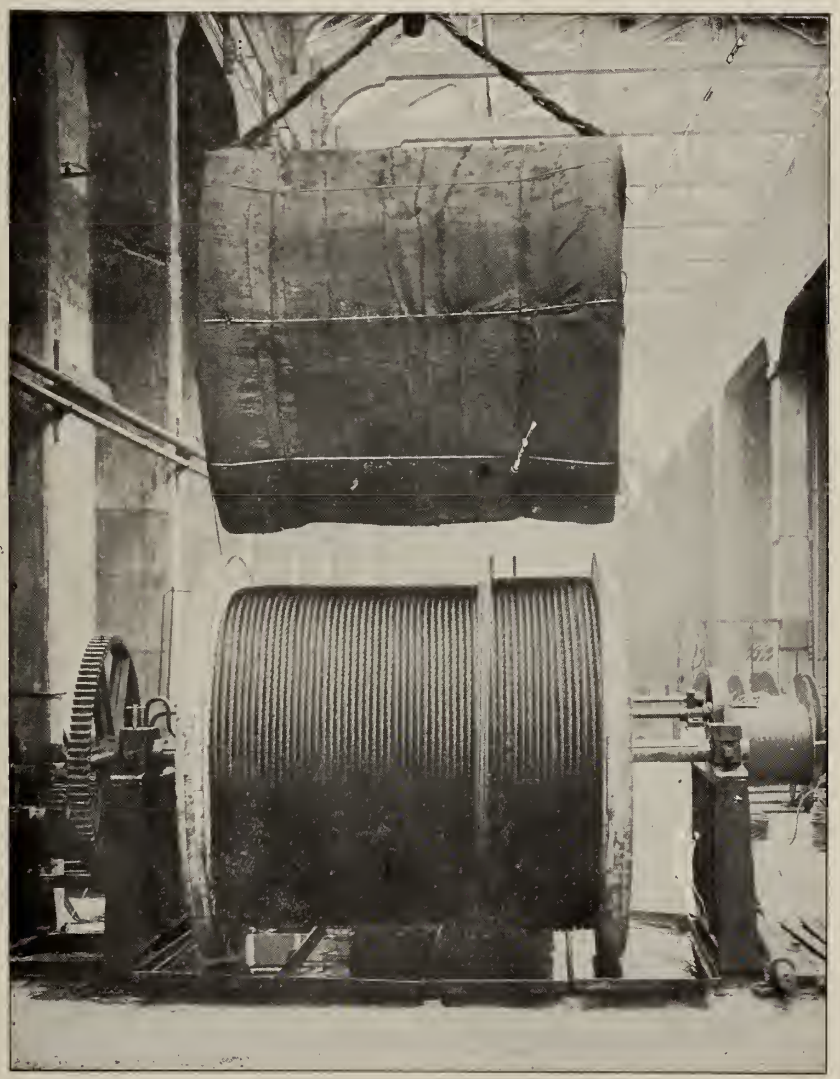
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For MINING:—
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

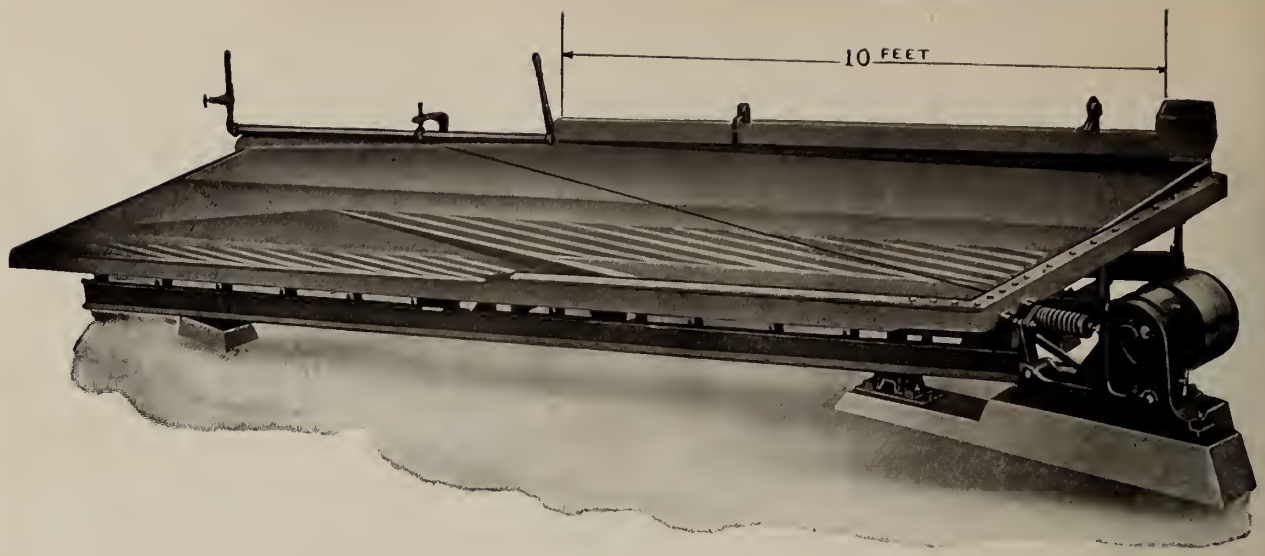
MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.:

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.



The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

CURTIS'S & HARVEY (CANADA) LIMITED
DRAGON BRAND

Best Quality Only

Explosives for Every Class of Work

400 St. James Street,
MONTREAL

JUNE 1, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 11

KNOWLES STEAM PUMPS

STEAM PUMPS
OF EVERY DESCRIPTION

We Solicit Your Pump Business.

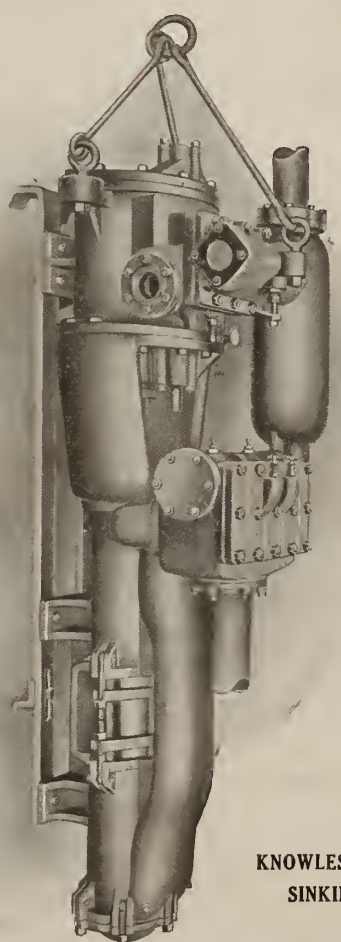
Your Enquiries will have our Prompt attention.

BOILER FEED and SINKING PUMPS
Carried in Stock—Quick Shipment

KNOWLES PUMPS
ARE ALWAYS ON THE JOB

Write us about your pump troubles.

CATALOGUES SENT ON REQUEST TO OUR NEAREST OFFICE



KNOWLES VERTICAL SINKING PUMP

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER 101 Water St.
QUEBEC 31 St. Louis St.
ST. JOHN, N.B. 57 Symthe St.
HALIFAX 78 Granville St.

Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.—58782.

TEMISKAMING AND NORTHERN ONTARIO RAILWAY

(ONTARIO GOVERNMENT RAILWAY)

SIR JAMES P. WHITNEY, Premier

Toronto, Montreal through Sleeping and Dining Cars to Timagami, Cobalt, Englehart, Elk Lake, Porcupine, Cochrane, traversing the far-famed Timagami Lakes---the Sportsmen's Paradise.

Through the rich and well-known Cobalt silver and Porcupine gold districts. Through the great clay belt---20,000,000 acres of rich agricultural lands await the settler.

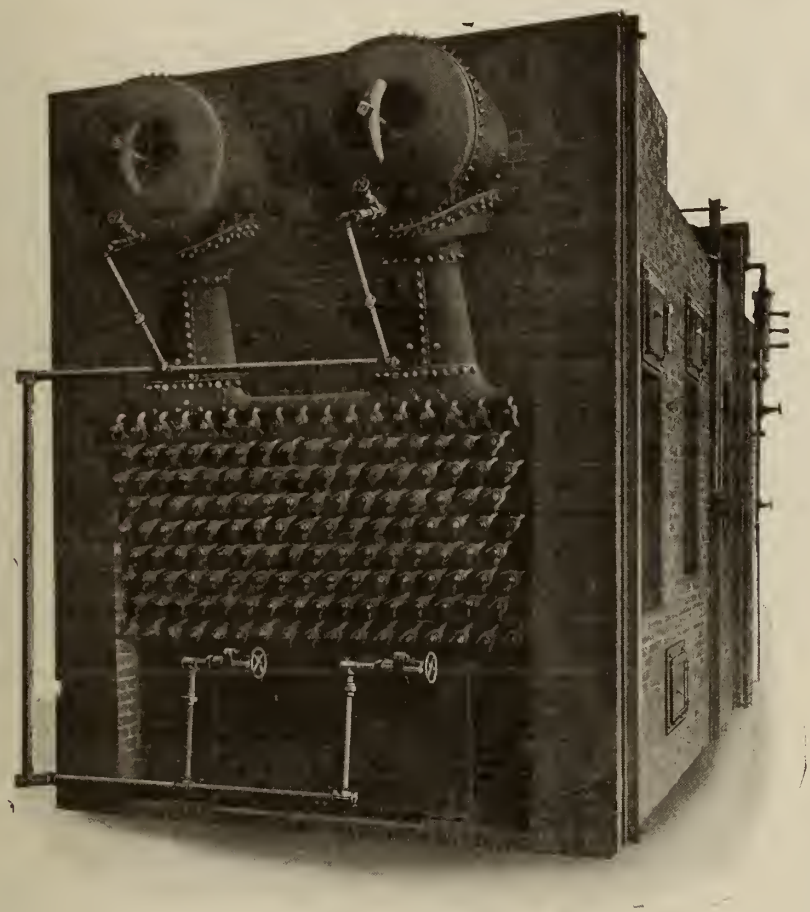
For full information, pamphlets, time tables, etc., apply:—

GEO. W. LEE,
Land Commr.,
North Bay, Ont.

A. J. PARR,
G. F. & P. A.,
North Bay, Ont.

A. J. McGEE
Sec.-Treas.
Toronto, Ont.

Union Water Tube Boilers



The steam producing end of a power plant is a matter of the most vital importance as far as the efficiency and economy of the plant may be concerned.

The four leading characteristics to be considered are SAFETY, EFFICIENCY, DURABILITY, and ECONOMY.

The UNION WATER TUBE BOILER excels in these four principal characteristics.

Strains due to unequal expansion cannot occur on account of the rapid, unrestricted circulation of the water and the corrugated drum-header connection.

Rapid circulation increases the efficiency by adding to the ability to absorb heat and prevents priming.

UNION WATER TUBE BOILERS are made to meet the specifications of all provinces.

A special patent feature is used for delivering the feed-water into the drum, and taking care of deposits of sediment and removing same from the Boiler.

Rock & Power Machinery
Limited

Canadian Agents for the Union Iron Works, Erie, Pa.

HEAD OFFICE: 12 King Street East, Toronto. Ont.

BRANCH OFFICES:

VANCOUVER; MONTREAL; HALIFAX; COBALT; SUDBURY;
AND IN THE KING EDWARD HOTEL, TORONTO

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For **Mining, Engineering** and **Shipping**: For **Hoisting** and **Haulage** in **Collieries** and **Mines**: For **Cableways** and **Aerial Ropeways**: For **Dredgers** and **Steam Shovels**: Specially Flexible Ropes for **Winches** and **Fast Hoists, Coal Towers** and **Cranes.**

OF THE HIGHEST QUALITY

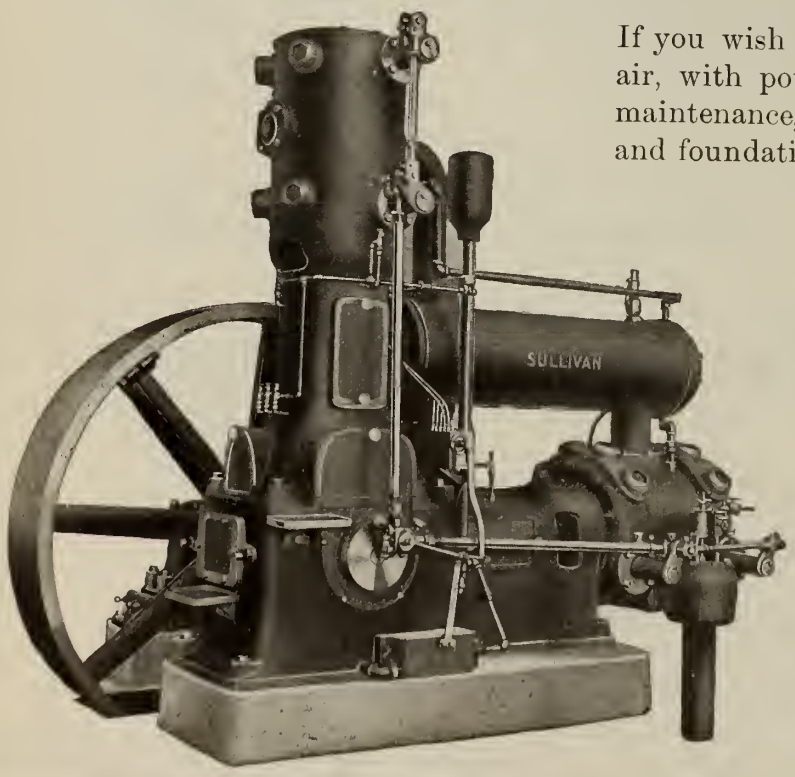
made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:--

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

Your Next Air Compressor?



If you wish to get the most actual compressed air, with power drive, at least cost for power, maintenance, care and attention, floor space and foundations, investigate

Sullivan Angle-Compound Compressors

In these "W J 3" machines, reciprocating forces are balanced, the drive is very adaptable, floor space and foundations are small, the working parts are few and the compressor is practically automatic.

Capacity, 400 to 1100 cu. ft.
Send for Bulletin 658-S.

Sullivan Machinery Co.
122 So. Michigan Ave., Chicago, U.S.A.
Montreal, Cobalt, Nelson, Vancouver

Butterfly Stopers

The Butterfly Stoper is arranged with a single throttle control which gives a variety of running conditions and very much facilitates operation. It is a decided advantage to the runner in starting a hole, particularly in a glancing surface.

Slight movement of this throttle handle not only regulates the speed of the hammer but also controls the pressure on the air feed leg. By this simple throttle control the tool is easily adapted to drilling conditions as they are found, whether hard or soft rock—high or low air pressure.

Butterfly Stopers are equipped with:

Automatic Lubricating Devices
Renewable Anvil Block Bearings
Spring retained front heads
Large Free Air Ports
The Non-Freezing Butterfly Valve
and they are described in Pamphlet K 202

Here is a letter from a user

"For my information would you please say how the work described below compares with similar work previously done in Canada.

From January 1st to January 27th, the raise extending No. 2 shaft from the 4th level to the surface, was advanced from footage 250 to footage 481, or surface. The raise was thru greenstone, and was inclined at 61 degrees. During the above period the shaft was timbered and divided into two compartments with square sets at 6 ft. centers.

Following is a record of the work:

Size of Shaft, 9 ft. x 17 ft.
No. of working days of 2 ten hour shifts each 22½.
No. of Blasts, 45.
Average cut, 5.11 ft.
Average No. ft. per day, 10.22 ft.

Eight machine men using Ingersoll-Rand "BC-21" Stopers, and four timbermen were used on each shift.

Yours truly,
(Signed) A. A. MACKAY"

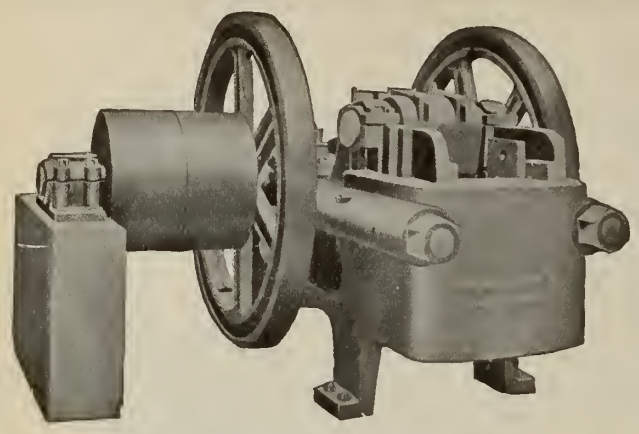
CANADIAN INGERSOLL-RAND CO., LIMITED.

COMMERCIAL UNION BUILDING, -:- MONTREAL, CANADA.

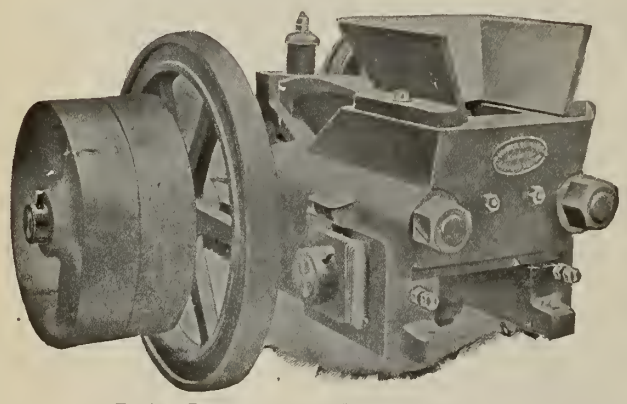
Works: SHERBROOKE, QUE.

Sydney Toronto Cobalt South Porcupine Winnipeg Lethbridge Nelson Vancouver

Write Nearest Branch Office for Further Information and Catalogues



Blake Crushers from 7" x 9" to 24" x 48"



Dodge Crushers from 4" x 6" to 11" x 15"

Blake and Dodge

CRUSHERS

The Blake Crusher is one of the best known and most successful of the moveable jaw type of crusher. As compared with a gyratory crusher, the Blake Crusher is much less expensive in first cost, upkeep and attention is considerably less, and the work even more satisfactory. These crushers are suitable to crushing down to one-inch cubes. Built of best material and workmanship throughout, and of a heavy type, these crushers will stand the most severe service.

The Dodge Crusher is a thoroughly reliable and practical machine. It possesses practically the same advantages as the Blake machine with the exception of being built somewhat smaller. Its use is specially advantageous when fine reduction is to be accomplished by a single crushing machine. The material and workmanship entering the construction of these machines are equal in every respect to that employed in our Blake machines. A special feature of the Blake and Dodge Crushers is that they are fitted with tie rods across the jaws to prevent breakage.

Crushers of all sizes carried in stock

Write for catalogues

FRASER & CHALMERS

OF CANADA, LIMITED

4 Phillips Place, MONTREAL

Assayers and Chemical Laboratory Apparatus and Supplies

Ainsworth Balances, Morgan Battersea Crucibles, Scorifiers, Furnaces, etc. Bone Ash, Test Lead, Litharge, Borax, Soda Ash, Soda Bicarbonate, Potassium Carbonate, Potassium Nitrate, Silica, Baker & Adamson C.P. Chemicals, Jena Glassware, German Porcelain Ware, Screens, etc.

ENGINEERS' and SURVEYORS' SUPPLIES

Drawing Materials, Surveying Instruments, Measuring Tapes, Brunton Transits. Large Stock always on hand.

PREPARE FOR FLIES

Save sickness and fever epidemics by the liberal use of **Screen Doors and Screen Windows. Fly Screening,** in rolls 18 in. to 48 in. wide.

REFRIGERATORS

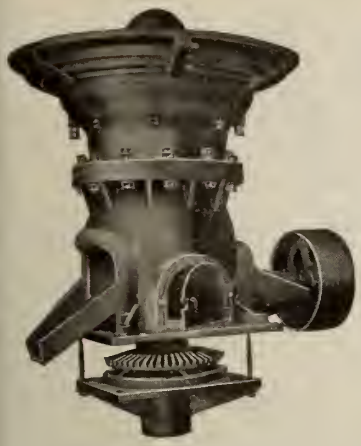
For every purpose—for home and camp use. Our prices are low.

CHLORIDE OF LIME

Destroys filth and unpleasant odors. In packages and drums from 1 lb. to 700 lbs.

THE GEORGE TAYLOR HARDWARE CO. LIMITED

NEW LISKEARD (Head Office) COBALT COCHRANE



Gyratory Crushers

MADE IN CANADA

Combining the Standard Features of this type of Crusher, and also our

Water Cooled Eccentric Bearing

Made in all sizes for all capacities and for crushing any kind of material.

We are building a full line of crushing, mining, cement making, hoisting and power machinery. Air Compressors and Rock Drills.

Write for Full Particulars

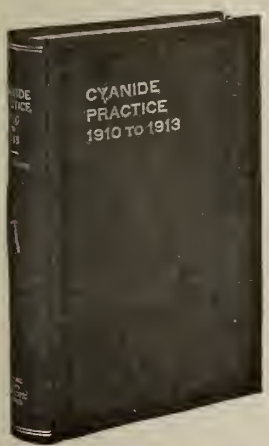
The Jenckes Machine Co., Limited

MAIN OFFICE and WORKS: SHERBROOKE, QUE

DISTRICT OFFICES:

St. Catherines, Toronto, Montreal, Cobalt, South Porcupine, Vancouver and Nelson

CYANIDE PRACTICE 1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.

140 illustrations

Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings:

Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

MINE TELEPHONES

—save time, prevent errors and increase efficiency. They closely coordinate a number of departments working independently, into a compact, harmonious, organization.

In case of emergency they make it possible to send warning and give instructions to all departments at the same instant.

Let us send a man from our nearest house to study the telephone requirements of your mine.

Northern Electric Company
LIMITED

Makers of the Nation's Telephones

MONTREAL WINNIPEG EDMONTON
HALIFAX REGINA VANCOUVER
TORONTO CALGARY VICTORIA

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

Montreal to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 583 Main Street, Winnipeg, Man. 52 King St. E., Toronto, Ont.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering courses leading to the degree of Engineer of Mines. Located in the Lake Superior mining district. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON MICHIGAN

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

SOLE MAKERS
OF
HADFIELD'S PATENT

"ERA" MANGANESE STEEL

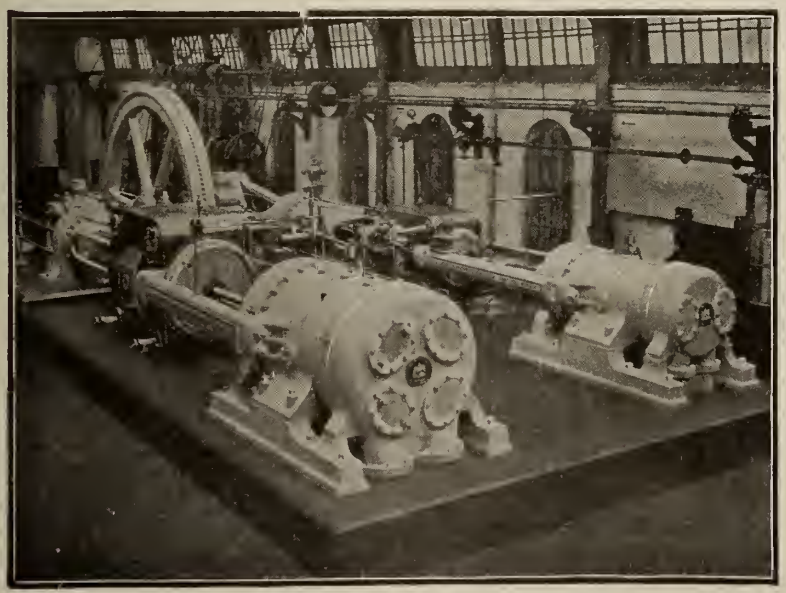
THE SUPREME METAL
FOR WEARING PARTS

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company
Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

FOR SALE

Steam Hoisting Engines and Pumps

The following machinery has been put out of service by an electric installation and is offered for immediate delivery, f.o.b. cars Stellarton, Nova Scotia.

1 Novelty Iron Works Steam Hoisting Engine. Duplex cylinders, 16″ diameter by 42″ stroke. Geared to 2 cast iron drums 9′ diameter by 56″ wide. Gear ratio 3 to 1, also 6,500′ of 1″ steel cable.

1 I. Matheson and Company's Steam Hoisting Engine, duplex cylinders, 16″ diameter by 30″ stroke. Geared to 2 cast iron drums 9′ diameter by 54″ wide. Gear ratio 2.4 to 1.

1 Jeansville Duplex Triple Expansion Pumping Engine, Steam cylinders 19″, 27″ and 44″ diameter, by 36″ stroke. Water cylinder 9″ diameter, together with jet condenser and condenser pump. Outfit capable of handling 1,000 gallons per minute against 1,800 feet head. Very low prices.

Address
Acadia Coal Company, Limited,
Stellarton, N.S.

ELECTRIC STEEL CASTINGS

Our Welland Plant will be ready to furnish Carbon, Manganese, Alloy Steel Castings and Forging Ingots by the end of May, made by the Electric Furnace Process. This process makes a dependable high-grade Steel and Steel Castings, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars.

THE ELECTRIC STEEL & METALS CO., LIMITED
WELLAND - ONTARIO

Shot
Blocks
Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.
43 Exchange Place — New York

ALSO
Electrolytic Nickel
(99.80% Pure)

WATEROUS BOILERS

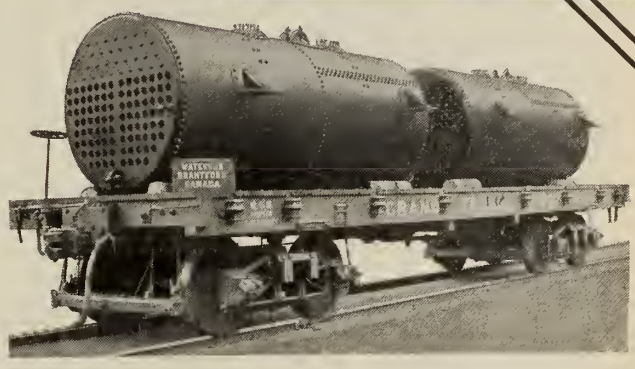
Waterous Return Tubular Boilers installed the Waterous way will give you the full steam value from the fuel you use.

Combined with the advantages possessed in general by this type of boiler—economy in fuel consumption, large steaming capacity, ability to use hard and dirty water, and comparatively low cost—we can furnish you with a boiler setting that is designed and dimensioned to best handle the fuel you use.

We build and carry in stock Return Tubular Boilers up to 72 in. x 18 ft. Let your next boiler be a Waterous.

SOME RECENT INSTALLATIONS

Canadian Pacific Railway, Calgary, Alberta.....2-60 in.x14 ft.
Okanagan Sawmills, Enderby, B.C. 2-66 in.x14 ft.
Lake Superior Iron and Steel Co., Sault Ste. Marie .....5-72 in.x18 ft.
Corporation of Orangeville .....1-54 in.x14 ft.
Dominion Canners, Simcoe .....3-72 in.x18 ft.
Grand Trunk R.R., Montreal . 2-72 in.x18 ft.
Steel Company. Ltd., Hamilton..2-72 in.x18 ft.
Dunlop Tire and Rubber Goods Co., Toronto.....1-72 in.x18 ft.
Imperial Oil Co., Ltd., Sarnia....5-78 in.x18 ft.
M. Oldfield & Sons, Grimsby ....2-66 in.x16 ft.
Canadian Westinghouse, Hamilton, 2-48 in.x14 ft.



The Waterous Engine Works Co., Limited, Brantford, Canada

LYMANS, Limited

MONTREAL

Headquarters for—

Balances
Crucibles
Crushers
Furnaces
Bone Ash
Borax
C.P. Acids and Chemicals
Etc., Etc.

Assay Supplies
Largest Stock in Canada

Assay Supplies
Largest Stock in Canada

Few Repairs

It is not so much how many holes a rock drill will put in per shift—but rather how long it will stay down in the mine. We absolutely guarantee that

"The Cleveland"

Stope Drill will not only do as much work as any drill made, but it will go longer without any repairs, takes less time to make the repairs, and gives better satisfaction all the time. And that is some guarantee.

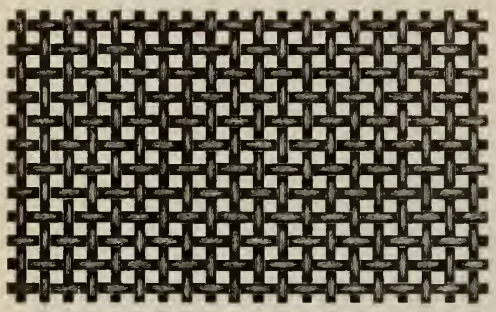
TRY ONE

Bulletin 40-A Mailed Free.

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street - TORONTO

GREENING'S

WIRE CLOTH - WIRE SCREENING



ALL GRADES OF WIRE CLOTH
DOUBLE CRIMPED

Screening Accuracy guaranteed.

Made of Steel, Copper or Brass.

Galvanized and Tinned Cloth.

PERFORATED METALS WIRE ROPE

The B. GREENING WIRE CO., Ltd.

HAMILTON, ONT. MONTREAL, QUE.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 14" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, NOVA SCOTIA

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

Imperial Bank
of Canada
Established 1875

HEAD OFFICE: TORONTO

Capital Authorized	$10,000,000
Capital Subscribed	$7,000,000
Capital Paid Up	7,000,000
Reserve Fund	7,000,000

Branches in Northern Ontario at
Cobalt, Porcupine, Elk Lake, Cochrane, New Liskeard and North Bay.

Branches in Provinces of
Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

BEATTY
Hoists, Clamshells, Derricks and Material Handling Equipment of every Description

Standard Two-Drum Hoist with Swinger.

Engines for every kind of hoisting duty.

BEATTY PLANT

on your work means uninterrupted service and complete satisfaction.

SEND FOR CATALOGUE, TO-DAY!

M. BEATTY & SONS, Limited
Welland - Ontario

AGENTS: H. E. Plant, 1790 St. James St., Montreal. H. W. Petrie, Ltd., Toronto. Rob't. Hamilton & Co., Vancouver, B.C. E. Leonard & Sons, St. John, N.B. A. R. Williams Machinery Co., Winnipeg.

SUPPORT HOME INDUSTRIES
THE CANADA METAL CO., LIMITED, MANUFACTURE IN CANADA

Our **BABBITT** Sales for **1913** Have Beaten All Records
Year by year they increase by Leaps and Bounds.

The Reason:

What we make we guarantee.

Nothing is done by guess work.

Mixtures and Physical Tests are controlled through our chemical and testing laboratories. All Babbitt Metals are tested with a friction testing machine.

This strict attention to details enables us to supply all requirements.

Ask for our booklet "Shakespeare and Babbitt Metals." Mailed Free.

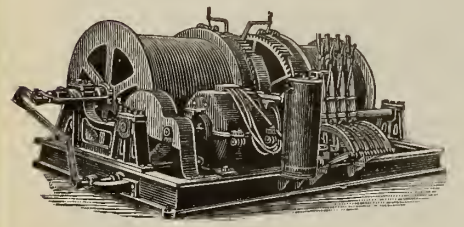
THE CANADA METAL CO., LIMITED
HEAD OFFICE AND FACTORY **TORONTO** BRANCH FACTORIES **WINNIPEG** AND **MONTREAL**

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

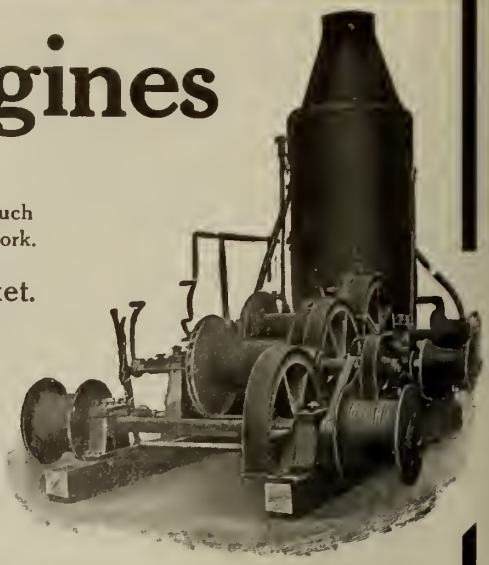


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



ASK FOR OUR CATALOGUES

S. Flory Mfg. Co.

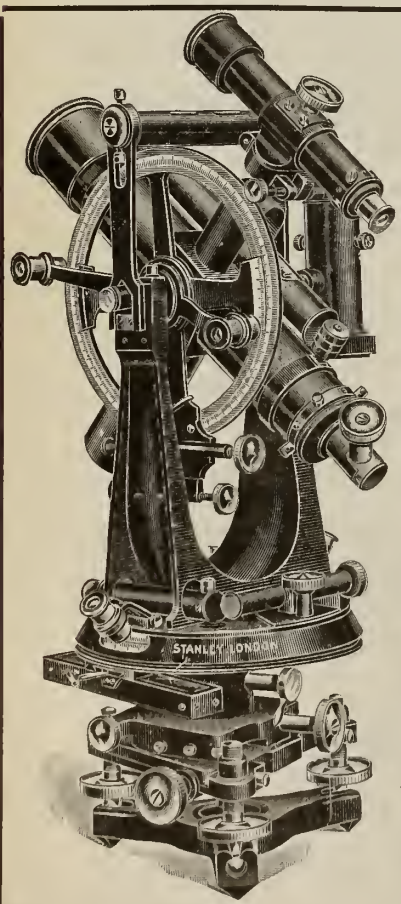
Office and Works: BANGOR, Pa., U.S.A.

SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL



Stanley's Dunbar-Scott Auxiliary Top and Side Telescope. Requires no correction for eccentricity.

Trade
STANLEY
Mark

The largest manufacturers of

SURVEYING and DRAWING INSTRUMENTS in the world.

DRAWING OFFICE STATIONERY of all kinds supplied on the most favorable terms. A very large stock kept.

Please send for our "K 35" Catalogue (post and duty free) and compare our prices with those of other first-class makers.

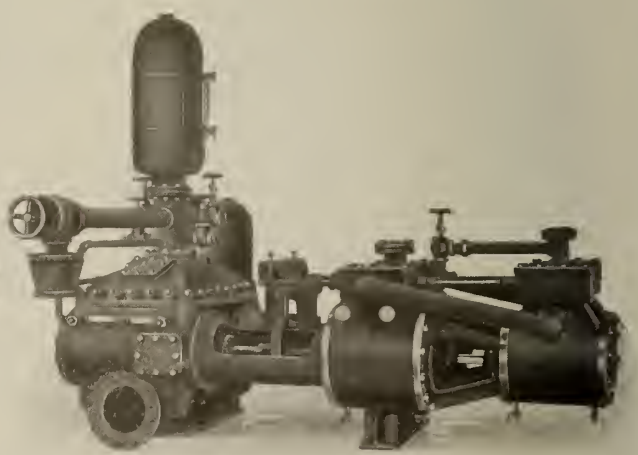
W. F. Stanley & Co., Limited

Export Dept.: Great Turnstile, High Holborn, W.C.

Head Offices and Showrooms:
286, High Holborn, London, W.C., Eng.

Our Pumps are in use from Coast to Coast.

Try us when you are contemplating a purchase.



The Smart Turner Machine Co.
LIMITED
Hamilton, Canada

Printing!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets.
Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm. Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

THE DAILY
Journal of Commerce

CANADA'S ONLY DAILY FINANCIAL NEWSPAPER

HON. W. S. FIELDING, President and Editor-in-Chief.
J. C. ROSS, M.A., Managing Editor
J. J. HARPELL, B.A., Secretary-Treasurer and Business Manager.

Special Wire to New York and Special Cable Service to London

Canada to-day has a yearly trade in excess of one billion dollars, while hundreds of millions of dollars of British and foreign capital is pouring into the country for investment. The country's banking institutions, her mining companies, her investment houses, her transportation systems, her manufacturing industries, her insurance companies and commercial houses compare favorably with those of any other country in the world. While the JOURNAL OF COMMERCE naturally deals chiefly with matters of finance and commerce, its news columns are by no means confined to that class of information. The general news of the day is covered in a condensed form and our aim is to present the very latest news concerning all important affairs. Whatever may be the important event of the moment, in any part of the world, it is promptly reported by the JOURNAL'S staff of correspondents.

Reliable News of all the Industries

Every person interested in Canadian Investments should be a Subscriber

SAMPLE ON REQUEST - - - SUBSCRIPTION PRICE, $5.00 PER ANNUM

Published Daily by

The Journal of Commerce Publishing Co., Limited

MONTREAL

Toronto Office: 44-46 Lombard St.

COLORADO

Mining Drill Steel

MANUFACTURED BY
Sanderson Bros. & Newbould, Ltd.
SHEFFIELD.

HOLLOW
Hexagon
SOLID

OCTAGON, HEXAGON, CRUCIFORM

Prompt Service from Large Stocks

H. A. DRURY CO., Limited

MONTREAL TORONTO NEW YORK

Standard Underground Cable Co., of Canada, Limited
Hamilton, Ont.
STANDARD C.C.C. WIRE
(Colonial Copper Clad)

This New Bulletin has been published for your information and should be in your files. It gives complete information regarding the properties and characteristics of 30 per cent.

Colonial Copper Clad Wire

TRADE C.C.C. MARK

If you are interested in copper clad wire for bond wires, bare wires or strands, rubber insulated or weatherproof wires, *write our nearest office for C.C.C. Specification Bulletin.*

Standard Underground Cable Co. of Canada, Limited

Hamilton - - Ont.

Boston, Mass. Montreal, Que.
Seattle, Wash. Winnipeg, Man.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade managanese ore occur at a number of different localities.

Tungsten-bearing ores ot good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

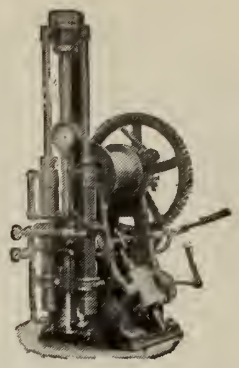
Diamond Drills

For Prospecting

Machines of all Capacities.

Product of over 35 years experience.

Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

POSITION WANTED

As superintendent or foreman, by one who has had wide experience in Mechanical Construction, Draughting, Designing and Erecting of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc. References. Will accept small salary until value of services is demonstrated.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY :—
528 Pender St. West,
VANCOUVER, B. C.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

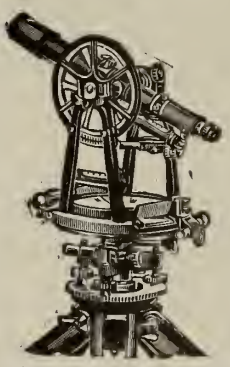
ALWAYS IN STOCK,

MORRIS CHAIN BLOCKS

THEY NEVER BETRAY.

THE HERBERT MORRIS CRANE & HOIST COMPANY, Limited

EMPRESS WORKS, PETER STREET, TORONTO.



Berger TRANSITS AND LEVELS

Latest designs in Instruments for Underground Surveying for all classes of work. Complete Catalog fully describing and illustrating these instruments, with **a large Manual giving full and concise directions** in the **care, use** and **adjustment** of instruments will be sent on request.

C. L. Berger & Sons, Boston, Mass., U.S.A.

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

Wet Grinding Tube Mill

COMPLETE INSTALLATIONS
for the
TREATMENT of ORES of EVERY KIND
especially GOLD ORES

Chemical and Metallurgical Laboratories.

Large Experimental Works equipped with full sized machines for Crushing and Ore Concentration.

FRIED. KRUPP A.-G. GRUSONWERK
Magdeburg (Germany)

Canadian Representatives:
Jas. W. Pyke & Co., Limited, 232 St. James St., Montreal

KRUPP
CRUSHING, CONCENTRATING & SMELTING MACHINERY:

Amalgamating Pans	Jigs
Amalgam Presses	Mercury Traps
Ball Mills	Picking Tables
Bucket Wheels	Retorts
Bullion Furnaces	Roasting Furnaces
Chilian Mills	Rolls
Clean-up Pans	Scoop Wheels
Concentrating Tables	Screens
Conveyors	Settlers
Cyanide Plants	Slime Tables
Edge Runners	Smelting Furnaces
Electro-magnetic Ore Separators	Sorting Belts
Grizzlies	Spitzlutten
Rotary Crushers	Stamp Mills
	Stone Breakers
	Trommels
	Tube Mills

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST LOW MAINTENANCE CHARGES

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.
OF CANADA, LIMITED
MONTREAL, CAN. ENGINEERS and MANUFACTURERS

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

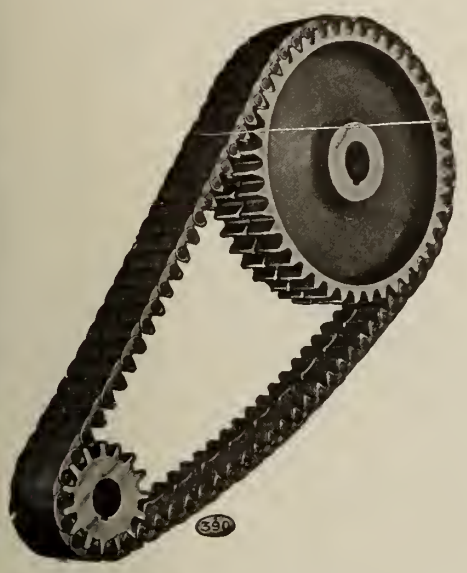
B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD PATENT SILENT CHAINS



The advantages are :—

Saving in Space

The chain drive only occupies one-third of the space occupied by the belt, as with chain drive it is possible to place the motor close to the shaft without any sacrifice of efficiency.

Saving in Power

Chain Drives being positive, there is no initial tension as with belts, and therefore none of the journal friction so caused. Consequently all the power is applied economically.

Regularity of Output

With the chain the speed ratio is perfectly definite under all conditions of load. This ensures a steady output with not only an increase in quantity but generally an improvement in quality.

Many other advantages given in illustrated catalogue sent on request.

JONES & GLASSCO (Reg'd) Engineers

Sole Canadian Agents

Branch Office, Toronto **49 Place D'Youville, MONTREAL**

Motor Capacity is more important than Price Per Pound in the selection of a Mine Locomotive

Buying an undermotored locomotive because it is cheap for the weight is not always economy. A smaller locomotive fully motored will do exactly the same work at less cost for current consumption, upkeep and maintenance.

Jeffrey Electric Mine Locomotives

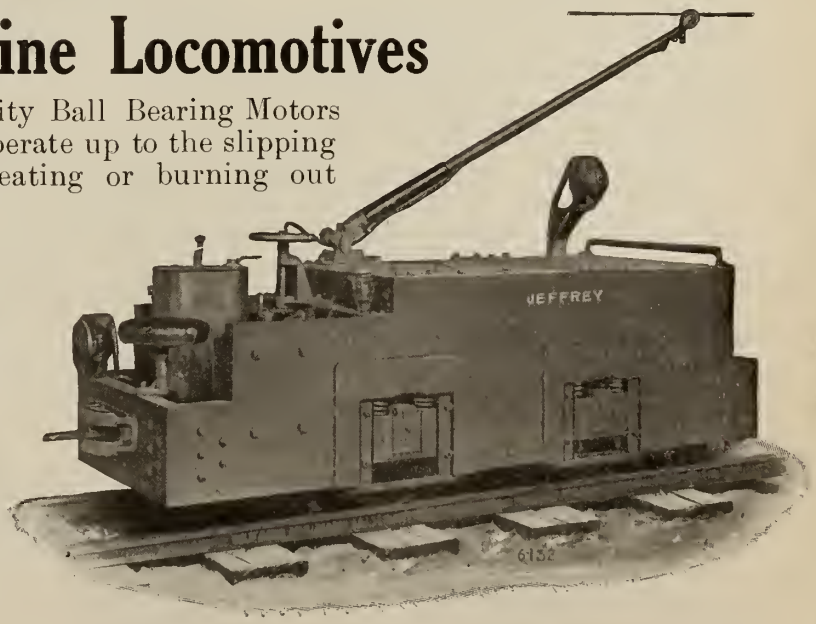
are equipped with Heavy Capacity Ball Bearing Motors which permit the locomotive to operate up to the slipping point of its wheels without overheating or burning out any part of the motor.

Ball Bearings on the armature shaft permit of large motor capacity for narrow gauges in metal mines.

Write for leaflet No. 19-A, illustrative and descriptive of Jeffrey Ball Bearing Motors. Also our complete Mine Locomotive Catalog No. 117.

Jeffrey Manufacturing Company

Canadian Main Office and Works, Montreal



6-Ton Electric Locomotive, designed and built especially for Ore Mines

A CHUCK THAT CHUCKS

THE SOLID TYPE CHUCKS INTO THE SCRAP HEAP

Why pay for more drill steel than you should use?

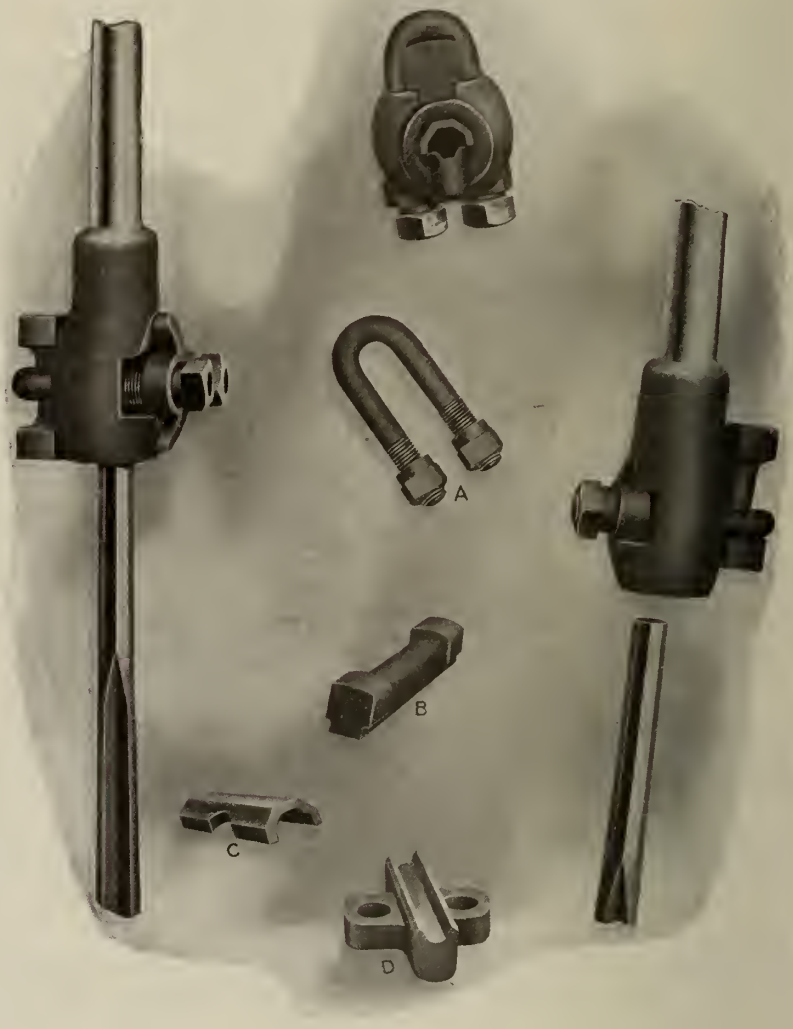
Why pay more blacksmith wages than are necessary?

Why pay more for "U" bolts and nuts than is needful?

You can save money on drill steel because there are no special shanks to break.

You can cut your blacksmith costs because there are no shanks to make.

You can lower your maintenance cost for "U" bolts and nuts because the steels can be tightened without wrenches. No stripped threads broken nuts or bolts.



THE HOLMAN DRILL CHUCK

THIS IS ONLY ONE POINT OF SUPERIORITY

of the Holman Steel Rock Drill. There are others.

THE DRILL YOU WILL FINALLY BUY

Send for Catalogue No. 51 to the Canadian Sales Agents

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
VANCOUVER, 101 Water St.
QUEBEC, 31 St. Louis St.
ST. JOHN, N.B., 57 Smythe St.
HALIFAX, 78 Granville St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, June 1, 1914. No. 11

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

Editorials—	Page.
Alberta Oil	361
The Iron Industry	361
Mr. A. A. Cole's Report	362
Correspondence	362
Jacket Water. By Geo. A. Guess	363
Hidden Coal Fields. By F. W. Gray	364
Calumet and Hecla Regrinding Plant	365
The Shields and Thielmann Jig	367
Field Work of the Geological Survey During 1914	368
Oil Discovered at Great Depth in Alberta	370
Progress in Nova Scotia Mining Industry in 1913. By F. H. Sexton	371
Relation of Geology to Mining. By F. H. Hatch	373
Iron Ore Washing Plants	376
The Massey Copper Mine Area. By A. P. Coleman	378
Surf Inlet Gold Mine, Princess Royal Island, B.C.	379
Mining Investments	381
The Formation of Metalliferous Deposits. By M. De Launay	385
Rossland Ore Deposits. By O. E. LeRoy	386
Mining Costs. By J. B. L. Hornblower	388
Relation of Big Business to Industrial Prosperity	389
Personal and General	391
Special Correspondence	392
Markets	396

ALBERTA OIL

The citizens of Calgary are suffering from another acute attack of oil madness and a number of promoters and brokers are doing their utmost to spread the disorder. According to recent despatches, syndicates are being hastily formed to absorb any money which a gullible public may part with while the mania lasts.

The results obtained at the discovery well of the Calgary Petroleum Products Company have been excellent so far. Some months ago oil was found at a depth of 1,560 ft. at Black Diamond, sixteen miles west of Okotoks, Alberta. This was a light colored oil, evidently consisting largely of gasoline. As such "white oil" is seldom found in large quantity the chief importance attached to its discovery was the probability of a larger deposit being nearby. Recently at a depth of about 2,700 ft. a larger deposit has been found. According to the reports the oil has risen several hundred feet in the well and has on occasions come to the surface. As gas exists in the higher horizons gushes are liable to occur at intervals.

Prospects for a large body of oil existing at considerable depth have been for some time regarded as good and the recent discovery may result in the development of an oil field of great importance. It would be a great boon to Alberta and to the Dominion. Those who have had the courage to drill to such depth deserve the rich reward which they have won and the thanks of the citizens of Calgary and of Canadians generally.

It would be well, however, for prospective buyers of Calgary oil company shares to make some investigation concerning what they are buying. That they will be offered shares in worthless property is to be expected. Such has always been the case in other oil fields. In the new field the same old game is being worked again.

Some time ago the Calgary Board of Trade issued a warning against speculation in the shares then being offered. It would be well if the Board would undertake a rigorous investigation of the offerings now before the public, with the object of exposing some of the worst of them. The earlier warnings have apparently been forgotten.

THE IRON INDUSTRY

The report of the Dominion Steel Corporation for the financial year ending March 31 reflects conditions common just now to nearly all producers. Decline in orders resulted in partial shutting down of the plants with large stocks of raw materials on hand.

Net earnings of the Corporation and its constituent companies amounted to $4,442,031.82. There was produced at the mines 5,047,683 tons of coal and 763,250 tons iron ore as compared with 5,053,100 tons coal and 757,003 tons iron ore in the previous year.

The production of iron and steel was, in tons: pig iron, 339,919; steel ingots, 331,256; blooms and billets, not further finished 35,299; rails, 176,027; rods, 30,-764; bars, wire nails, etc., 41,522.

The figures show that production of coal, iron ore, pig iron and steel was about the same as in the previous year. The report indicates, however, that during the present year there will be a smaller production from the mines. The steel plant is in good condition for a large output, but orders are scarce.

MR. A. A. COLE'S REPORT

The annual report on the mining industry in that part of Northern Ontario served by the T. &. N. O. railway, has been issued. Like the previous reports, this one contains much useful information and is well illustrated.

Mr. Cole calls attention to the development of the district served by the railway and shows conclusively that the mining industry has contributed largely to the success of the railway and the development of the districts. In 1913 the freight revenue credited to mining was $444,499.55, or 48 per cent. of the total.

The gold production of the Porcupine district is shown to have amounted in 1913 to 29 per cent. of the gold production of the Dominion and 95 per cent. of that of Ontario. A considerable increase in 1914 is expected. The production at Porcupine in 1913, according to Mr. Cole, was $4,284,928.

The silver output of the Cobalt district in 1913 is valued at $16,555,001 as compared with $17,390,218 in 1912. Milling operations assumed much larger proportions than ever before. There was milled in 1913 664,845 tons of ore as compared with 455,517 tons in 1912. Of the total there was treated in cyanide mills 133,297 tons and in water concentrating mills, 531,548 tons.

The report contains a number of illustrated descriptions of the mills and the processes of treatment, and reflects the constantly growing importance of Cobalt and Porcupine as metallurgical centres.

CORRESPONDENCE

THE KIRKLAND LAKE PORPHYRY.

Editor Canadian Mining Journal:

Sir,—In regard to the porphyry of the Kirkland Lake District the name "diorite-porphyry" as suggested by Messrs. Tyrrell and Bell, is probably the most appropriate that can be applied to the acid porphyries of the district in general, yet there are many graduations. Some types have predominating orthoclase phenocrysts, and some have predominating plagioclase phenocrysts. Probably the porphyry with predominating plagioclase phenocrysts is the most widespread. The thin sections examined by myself were made from rock selected near the ore bodies and not from other parts of the field. From hand specimens selected from different parts of the field, it appears that soda-lime plagioclase rocks predominate, but this distinction matters little apparently from the standpoint of the genesis of the deposits. The deposits are associated with a porphyritic rock having acid feldspar phenocrysts and little or no quartz, ranging from syenite porphyry on one hand to diorite-porphyry on the other.

In my article in the May 15 issue of the Journal it is stated that "many of the pebbles in the uptitled Temiskaming conglomerate are typical feldspar porphyry pebbles identical with pre-Temiskaming feldspar porphyries exposed in the Kirkland Lake District." The latter part of this sentence should read "identical with the acid feldspar porphyries as exposed in the Kirkland Lake District, which shows a period of intrusion pre-Temiskaming in age."

CHAS. SPEARMAN.

Haileybury, May 18, 1914.

MINE ACCIDENTS IN BRITISH COLUMBIA.

Inaccurate statements relative to mine fatalities in British Columbia having repeatedly been made, both on the public platform by ill-informed speakers and in printed publications, the Minister of Mines for the Province has adopted the recommendation of the Chief Inspector of Mines, Mr. Thos. Graham, that an official report of the number of fatal accidents in coal and metal mines for the province be published quarterly. Accordingly, the statement for the first quarter of 1914, compiled by Mr. Graham, has been printed and distributed. This gives the information that the reports received from district inspector of mines and from operating mining companies show that during three months ended March 31, 1914, there were 12 fatal accidents, of which 7 occurred in coal-mines and 5 in metal-mines. Comparative tables exhibit (1) the number of fatalities in each month of the quarter, with figures for the corresponding period in 1913: (2) the collieries and metal-mines, respectively, at which the fatalities occurred; and (3) a classification of the causes of the accidents that led to death.

From the first table it is gathered that the coal-mine accidents occurred in months as follows, the figures in parentheses being for 1913 and the others for 1914: In January 1 (2), February 4 (1), March 2 (4); total, 7 (7). Table 2 shows that of this year's fatalities, 3 occurred at the Canadian Pacific Railway Co.'s Hosmer colliery, one at the Crow's Nest Pass Coal Co.'s Michel colliery, two at the Cumberland (Comox) colliery of the Canadian Collieries (Dunsmuir) Limited, and one at the Western Fuel Co.'s colliery at Nanaimo. From Table 3 it is learned that causes of death were: From falls of roof and rock 2 (5), falls of coal 1, mine-cars and haulage 1 (2), suffocation in fine coal 2, and—on surface—killed by a coke-oven larry 1.

Tables relating to metal-mine fatalities show that deaths occurred in the following months: January 1 (2) and March 4 (1); total, 5 (3). Table 2 shows that there was one death at the Rambler-Cariboo mine, Slocan; 1 at the War Eagle, Rossland; 1 at Anyox, Skeena mining division; and 2 at the Jewel mine, Boundary. Table 3 gives causes of death as follows: Picking or drilling into unexploded powder 1 (1), premature blasts 2 (1), suffocation by powder fumes 1, falling into winzes, etc., 1 and falls of ground none (1).

JACKET WATER

By Geo A. Guess, Professor of Metallurgy, University of Toronto.

Very little information is available regarding the water necessary for the jackets in a modern copper blast furnace, or the amount of heat that is carried away by such water. It would be very interesting if some of those now engaged in such work would publish the figures for their particular plants. Where water is plentiful and cheap there is usually permitted to run through the jackets an excessive amount. The result is that the jackets are kept cold and a little more heat is lost from the furnace charge. The difference in the heat lost from the furnace when the jacket water is run cold and when run hot is really insignificant. Where, however, water is scarce, or the pumping an important item in the plant, the jacket water is run as hot as possible in order to cut down the water used or the pumping to be done. Economy in the use of water is difficult to enforce, as furnace men are apt to carry plenty of water in order to avoid the troubles from a boiling jacket.

Corrosion of pipes.—Jacket water may run to waste but is usually pumped back to the stock tank, from which it flows by gravity again to the jackets. If plenty of water is kept in circulation, or if a considerable amount of new water is introduced in the system, the temperature of the water may be kept down. This new water not only keeps down the temperature, but keeps down the acidity. Circulating water is bound to pick up considerable flue dust, which will contain soluble sulphates and some free sulphuric acid, and the result is that pipe lines are destroyed and pipe fitttings about the furnace, particularly nipples, are eaten through. So when new water is not available, we find the circulating water becoming acid and also hot.

Cooling towers.—In a country not troubled with frosts and where the humidity is low, the logical treatment for hot water is the cooling tower. Where the humidity is at all high, the cooling tower is, however, quite useless. Such towers are rectangular, with sloping sides, about 20 ft. high, having a sump at the bottom. The warm water is distributed from launders over its top. It may have, say, 20 storeys, the floors being of 1 in. stuff, about 4 in. wide, laid 4 in. apart. The boards are staggered so that the gap on one floor corresponds to the board above or below. Louvres protect the sides, and also permit free access of air. This free access of air is essential. and cooling towers are made narrow, to get efficiency, and long in order to get capacity. If wide, the central portion of a cooling tower does very little work. The capacity of a properly constructed cooling tower depends on:

1. The difference between the temperature of the water and the air.
2. The humidity of the air.

The capacity is conveniently expressed in B. t. u.' s per sq. ft. of wetted surface per minute.

The capacity of a cooling tower that was built too wide was found to be from 11 to 12 B. t. u.' s per minute per square ft. of upper wetted surface of slats when the difference between the air and water temperature was 30° F. and the humidity was 5 per cent.

The choosing of a site for a cooling tower is a matter of importance. In the first place it should occupy an exposed position, so that the air has free access, and its sump should be high enough to supply the furnace jackets. It should never be placed where sulphur smoke may be carried to it. If the wind carries sulphurous smoke to the tower, the falling water will become quite acid in a few hours.

The distributing launders should give a uniform distribution of water and should be provided with gates, so that their feed may be shut off and the accumulated mud and slime removed periodically.

When the jacket supply circulates with a minimum amount of new water it not only becomes acid; but will deposit in the dump of the cooling tower mud composed of fine dust, fume, ferric salts and insoluble sulphates. It will be necessary to renew the whole of the circulatory water occasionally. The dump should be accessible for cleaning on these occasions.

The most satisfactory neutralizer for jacket water acidity is sodium carbonate. The amount necessary to add may be calculated from a titration of a sample of the water. Although a small amount of arsenious acid in the water will protect iron in many cases; it does not seem to be effective in protecting pipes, etc., carrying jacket water.

The amount of heat carried away from a furnace through the jackets is not as large as might be supposed. This is due to the formation of a crust next the jacket, which will have a low heat conductivity. The hot jackets that would result when blowing in a furnace, if plenty of water were not used, is due to the absence of this crust. Some measurements taken by the writer over a month's operations showed that 4,750 ton calories per ft. of furnace length per day were lost in the water. This was for a plant smelting copper ore in the ordinary manner, with about 10 per cent. of coke on the charge. During the month 2,635 U. S. gals. per min. circulated for 8 furnaces, aggregating 111 ft. in length. In pyritic smelting, 1,490 ton calories per ft. of furnace length per day was found to be normal. The lessened heat loss is due to the thicker protecting crusts on the pyritic furnace.

INTERNATIONAL ENGINEERING CONGRESS, 1915

Among the general subjects to be treated before the International Engineering Congress, 1915, probably the one having the broadest interest is that of Materials of Engineering Construction, which enters into all phases of engineering activity.

The papers to be presented from the United States have already been arranged for from the recognized leading authorities on the various topics. Arrangements for the papers from foreign authors are being rapidly concluded, and the aggregation of papers which will be presented will constitute a broad review of the field and be of the highest value.

Marked interest in the Congress from foreign countries continues, and there is every evidence that the attendance from abroad will be large.

Full information concerning the Congress, the price of subscription, and the arrangement for purchase of volumes of the proceedings, may be obtained by addressing the Committee of Management, as follows:

International Engineering Congress, 1915.
Foxcroft Building.
San Francisco, Cal., U. S. A.

HIDDEN COAL FIELDS

By F. W. Gray.

At the annual general meeting of the Institution of Mining and Metallurgy, held on March 26th, the president of the institution, Dr. F. H. Hatch, took for his presidential address the subject, "The Relation of Geology to Mining." Dr. Hatch's remarks on concealed coal fields are of particular interest to the mining engineers of Great Britain, where remarkable discoveries of hidden coal fields have followed the application of inductive geological reasoning.

From the report of the address given in the "Iron and Coal Trades Review," the following interesting observations are abstracted:

"Specific instances, continued Dr. Hatch, of the successful application of geological knowledge to mining work can, of course, be given in abundance. In this country (Great Britain) the proving of the underground extension of the coal fields beneath the younger rocks surrounding them is of paramount importance to its industrial welfare. One of the first pieces of work in this direction resulted from the admirable mapping of the Midland coal field by Beete Jukes, a distinguished member of the Geological Survey of England and Wales. The entire correctness of his theories was demonstrated by the proving of the prolongation of the South Staffordshire coal field to the east under the fringe of overlying red rocks. Similarly, the discovery of a buried coal field in the southeast of England was the direct result of a piece of pure scientific deduction. Goldwin-Austen argued that the tectonic folds in the Paleozoic floor, by which the existence of coal basins are determined, would be traceable even when covered by a great thickness of newer rocks, because a line of disturbance, whether of faulting or folding, tends to be the locus of subsequent movement, and thus to set its mark on the newer strata. The correctness of this tectonic principle was demonstrated by the successful borings in the neighborhood of Dover, which showed that deeply buried under Mesozoic and Tertiary strata is a coal field, situated on the line connecting the seams worked in northern France and Belgium with those of South Wales and Bristol; and it appears not improbable that other coal areas might be found, if the underground geology of this line of country were systematically explored. A satisfactory feature of the discovery of buried coal fields in England is the large additions thereby made to our coal resources, as to which previous estimates had been rather pessimistic."

A line connecting the coalfields of northern France with those of Kent, the Forest of Dean and South Wales approaches very closely to London, and it does not require much imagination to see the industrial possibilities of the South of England if coal fields were to be discovered at a workable depth in a district that has London for its centre. Similar scientific deductions to those referred to by Dr. Hatch have led to the finding of buried extensions of coal fields in the Campine district of Belgium and in the Lippe Valley in Germany.

In Cape Breton Island and in New Brunswick the carboniferous appears to have been the latest formation laid down, and there does not appear to be any likelihood of the discovery of concealed coal fields, because of the absence of formations younger than the carboniferous. But in the Pictou and Cumberland counties there is a possibility of finding the coal measures under a mantle of younger strata. The possible occurrence of a coal area beneath the Neo-Carboniferous or Permian strata of Pictou county was discussed in a paper read before the Canadian Mining Institute by Dr. H. M. Ami, who set forth the extreme probability of a possible coal field "beneath the newer outlying series, and in the inclined beds below" in that portion of Pictou county north of the "North Fault." The greatest development of younger rocks under which there is a probability of the presence of coal seams is in Cumberland county. The tract of country bordered by Chignecto Bay on the west, having the Joggins mines at one extremity and the mouth of the Apple River at the other, and bounded by the Cobequid Hills on the east, running from Apple river to Halfway river, thence to Springhill Mines and back to the Joggins Mines, is covered by strata younger than the Carboniferous, and this district affords greater possibilities in the way of concealed coal seams than any other part of Nova Scotia.

Prince Edward Island should by all geological reasoning contain coal seams, but whether these seams are present at a workable depth will depend on the existence of folds in the presumably concealed Carboniferous formation. In a borehole, which was put down near Miminegash, at the extreme western end of the Island, the depth of the red Permian beds was only 950 ft., the remaining 710 ft. being in the lower grey beds of the Permo-Carboniferous. This borehole was most unfortunately lost before the Carboniferous rocks had been tested, but sufficient evidence was obtained to prove the very interesting field Prince Edward Island presents for just such geological deduction as has led to the discovery of hidden coal fields in such old world districts as Kent and the Belgian Campine.

In commenting on Dr. Hatch's address, the "Colliery Guardian" editorially remarks: "Whatever may be the theoretical arguments in favor of a concealed coal field, the borehole must necessarily become a final test, but without the aid of tectonic geology no borehole evidence can be properly and fully interpreted." It is to be deplored that the Miminegash boring was so inconclusive in demonstrating whether the productive measures of the Carboniferous are to be found under Prince Edward Island or not, but whatever evidence was obtained pointed rather to the probability of the presence of the productive measures than otherwise. Enough has been cited, however, to point out that all the possibilities of the Maritime Provinces in the matter of coal fields have not been exhausted.

CANADIAN OIL FIELDS.

There are comparatively few important oil producing districts in Canada. The principal production is from Southwestern Ontario between Lake Huron and Lake Erie. Lambton, Kent and Brant counties yield large quantities.

Some oil is produced in the district south of Moncton, New Brunswick.

PETERSON LAKE.

The first dividend on Peterson Lake is payable June 15th to stock on record May 15th, Dividends of 1¾ per cent. will be paid quarterly.

CALUMET AND HECLA REGRINDING PLANT

During the many years of operation of the Calumet & Hecla stamp mills, there has accumulated an enormous tonnage of tailings, which it is now proposed to retreat. A few years ago it was estimated that the 30,000,000 tons of sand could be profitably treated to yield about 150,000,000 lb. of copper. It is now estimated that a considerably larger recovery can be profitably made by a combined concentration and leaching process. The concentration will be effected on Wilfley tables after regrinding of the sands in Hardinge pebble mills. The leaching process devised has not yet been made public.

The recrushing process has been satisfactorily demonstrated and a large plant has been recently erected and will soon be in operation. To raise the sands from the lake a steel dredge has been built. Centrifugal pumps will be used to raise the sand and deliver it at a "shore plant." Thence, after draining, the sand will be elevated on a belt conveyor to the regrinding plant.

This plant is housed in a steel building 123 by 432 ft. in size. On the upper floor are, or will be, 64 Hardinge conical pebble. On the lower floor are the Wilfley tables.

The mills being installed are 8 ft. in diameter and have a cylindrical length of 18 in. Various lengths of cylinder have been tried in and the short cylinder, after long trial, was selected as the most economical. Each mill is driven direct by a separate motor.

The accompanying photographs show general view of the regrinding floor as it appeared in January and a view of a completed section as it appeared in April. The second photograph shows the discharge end of the mills, the launders, and the individual motors which drive the mills.

Hardinge Mills in Calumet and Hecla Regrinding Plant

In addition to the Wilfley tables on which the reground material is treated, the building houses several Wilfley tables which will be used to treat the fine material separated from the coarser sand in settling boxes at the shore plant.

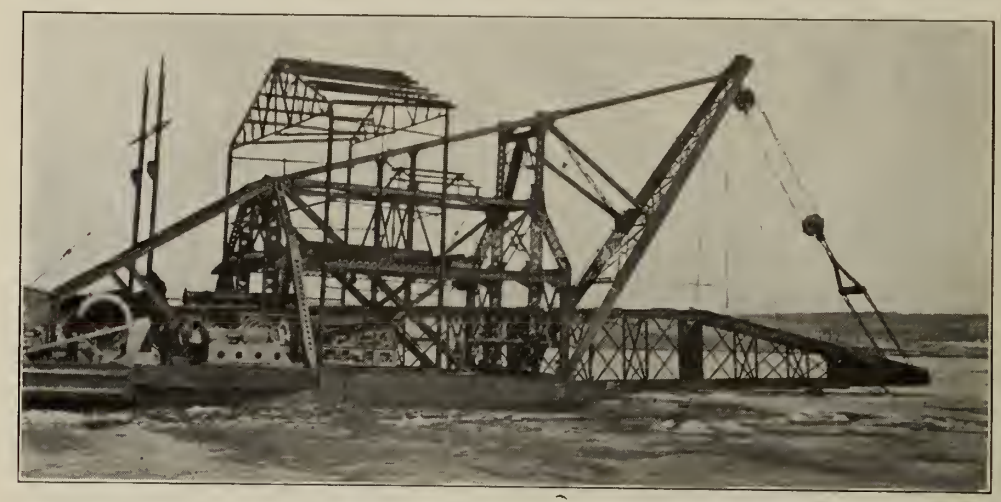
Assuming a recovery of 5 lb. copper per ton at a profit of 5 cents per pound, the profit from the treatment of the Calumet and Hecla sands by regrinding and concentration should be $7,500,000. A further large profit will be obtained by the leaching process if it proves as successful as the experiments indicate.

Calumet and Hecla Regrinding Plant, Lake Linden, Mich.

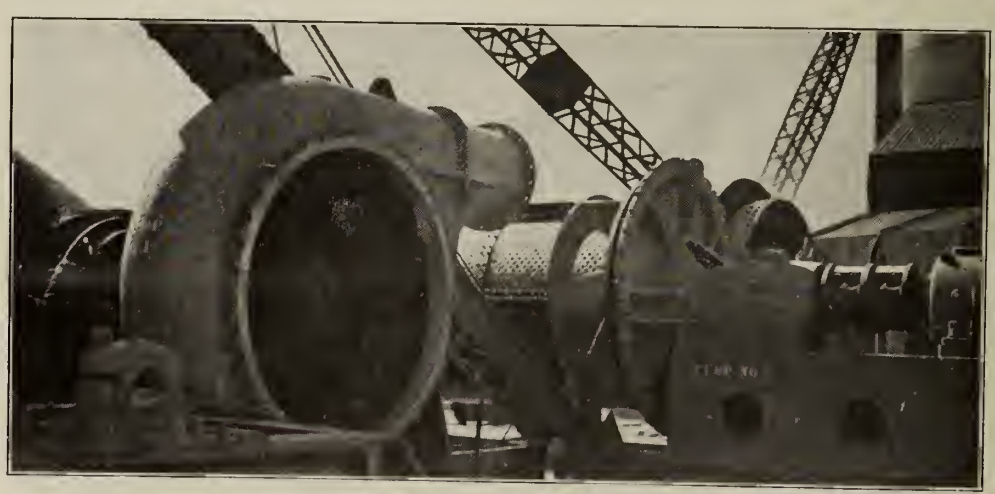
THE TRAINING OF MINING GEOLOGISTS IN GREAT BRITAIN.

Sir Thomas H. Holland, in an address dealing with the university training of mining men, says in reference to the mining geologist:

"While the training of the mine manager should be about three-parts of purely technical methods supplemented by about one part of scientific prineiples, in the education of the mining geologist the ratio of these ingredients should be inverted. One is a technical man; the other is a technologist. One is trained mainly at the mine, supplemented by out-of-shift classes; the other may be edueated at the university, and obtain a smaller practical experience at more than one class of mine. The mining geologist need not be able to handle as an expert every form of machinery at a mine; but he should know enough of the methods of mining to know how to direct his prospecting operations in an undeveloped area in such a way as to take into account the conditions that may or may not make subsequent mining operations possible. His experience of mining methods would be more general and less intensive than that of the man trained to be a manager, while his knowledge of economie mineralogy would naturally be wider than that of the manager who handles but one or two kinds of produets. He would bridge the embarrassing gap that now exists between our purely academic geologists and our technically trained miners. For the training of this class little has so far been accomplished by British Universities; but it is the out-turn of men approximately of the kind just defined that has mainly made the good name of the Royal School of Mines."



Dredge No, 1. Calumet and Hecla Mining Co.



Centrifugal Pump, Dredge No. 1. Calumet and Hecla Mining Co,

HOLLINGER.

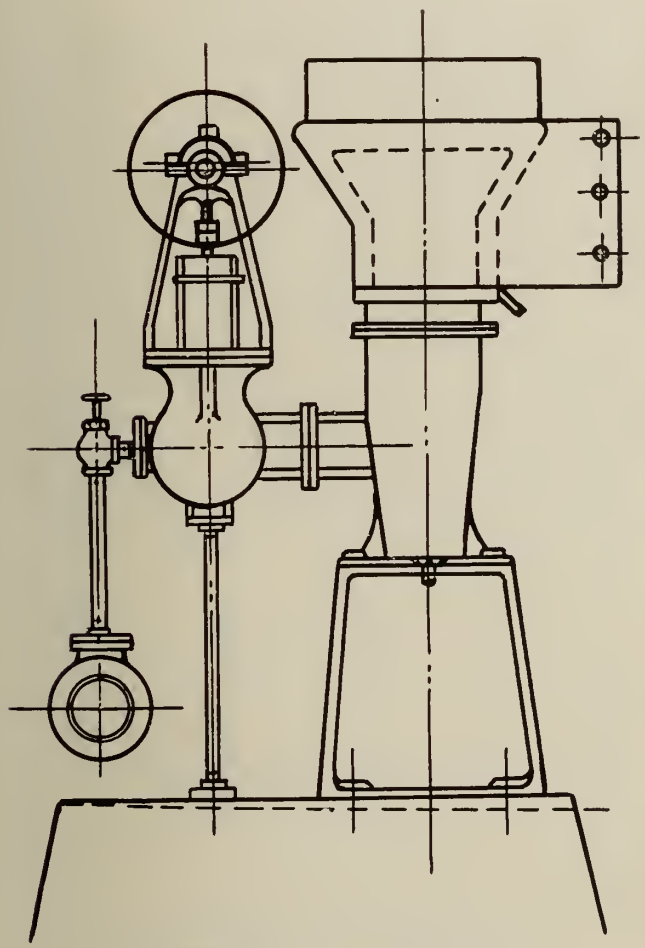
Gross profits of Hollinger Gold Mines for the four weeks ending April 22nd 1914 amounted to $123,523,-15, $9,305.63 was expended on plant. Working costs totaled $61,660.48, an average of $4,349 per ton of ore milled. Mr. A. R. Globe, assistant general manager, reports as follows: "The average value of ore hoisted was $13.69. Waste rock from development amounting to 1,364 tons was hoisted, bringing the total of ore and waste up to 16,387 tons. The mill ran 93% of the possible running time, treating 15,191 tons, of which 1,013 tons were treated for the Acme Gold Mines, Limited.

"The average value of Hollinger ore treated was $13.69 per ton; approximate extraction was 95.1%. Milling costs were $1,083 per ton.

Work in the mine continues to yield satisfactory results. By means of diamond drilling on the 100-feet level No. 13 and No. 36 veins were located, showing a medium grade of ore, six and seven feet in width respectively. The 550 feet level has been sufficiently developed to permit sinking on No. 8 winze which is being sunk to the 675 feet level.

THE SHIELDS & THIELMANN JIG

A machine has been designed at the Quincy stamp mills, Michigan, that tends to revolutionize the treatment of the so-called roughing floor material. It has been in successful operation for eight months, and the results have been better than was expected. The machine takes up a space of about 12 ft. by 4 ft. and has a capacity of 500 tons.



THE SHIELDS & THIELMANN JIG

The machine is called a sectional positive jig Classifier. It is made up of a number of sections, which are divided into pockets of 6 by 12 in. and 12 by 12 in. in size, each having a positive plunger, and an independent adjustable stroke ranging from 2½ in. to 0.

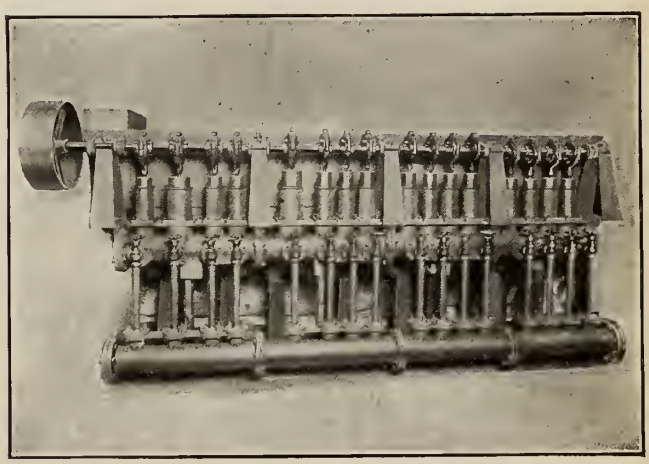
This is very essential as to the treatment of the different sizes of material, ranging from ⅝ in. to 100 mesh. The plungers are all made of brass, and each plunger carries an oil bath inside submerging the pin on the plunger at all times in a bath of oil. The plunger casings are made of cast iron, and are independent of each other, and can easily be removed or replaced.

The sections are lined with a cast iron box to protect the sections proper from wear and at the same time they conform as to shape with the partitions in the hutch pockets. Each pocket has a plug of its own, and the material from each pocket is discharged independently.

At the Quincy mill the feed that enters the jig comes direct from the stamp and is an unsized feed from ⅝ in. down to slime product. The heavy ⅝ in. copper, ½ in. copper and a large portion of the ⅜ in. copper and under is discharged from plugs Nos. 1, 2 and 3 above the sieve. The hutch copper, which ranges from ⅜ in. down to table copper, is discharged through the sieve into the hutch of section No. 1 as clean concentrates. Clean concentrates are discharged also from the second section into the hutch.

The very fine slimes, containing the very fine copper, are held in suspension and discharged at the tail end of the machine in the form of slime ranging from 80 to 100 mesh.

The amount of copper taken out by this machine is 70 per cent. of the total copper from the stamp head. This product will assay 80 to 95 per cent. copper. The amount of ⅝ in. gravel taken out by this machine is 125 tons per 24 hours, which is taken out of plugs Nos. 4 and 5, which replace the trommel screens. The amount of middlings taken out to be ground is 100 tons, which is taken out of plugs Nos. 9 and 10. Plugs 6, 7 and 8 are left blank to accumulate concentrates, which may be drawn off when necessary. Rich middlings accumulate in the second section.



The third section discharges material from the sieve. This requires only a table treatment, as the material is too poor to grind. The material, however, from the Nos. 3 and 4 sections is all classified, ranging from ⅛ in. to 40 mesh, and amounts to about 150 tons, classified into eight different products. The hutch product is enriched from Nos. 3 and 4 sections and makes an ideal table product, no further treatment being necessary. This hutch product amounts to about 50 tons per 24 hours.

Among the advantages claimed for the machine are: It has an adjustable sieve for deepening or lessening the bed. It has an independent motion for every pocket. It has an independent water supply for every pocket. The motion is positive at all times, and does away with ponderous sieve frames, plunger boards, sieve wire, power space, etc. It is a concentrating mill by itself, and handles from 450 to 500 tons per 24 hours.

DOME LAKE.

A by-law providing for a new issue of 100,000 shares of stock to be sold at 50 cents was introduced at a recent meeting of the Dome Lake directors. It is understood that the money raised will be used in installing a cyanide plant and in carrying on development work.

FIELD WORK OF THE GEOLOGICAL SURVEY DURING 1914

Geology.

Under the direction of O. E. LeRoy, who is in charge of field work in geology, a large number of parties will be carrying on detailed geological investigations, reconnaissance and exploratory work throughout the country.

The examination and areal mapping of the gold-bearing series of Nova Scotia as developed in portions of Queens and Shelburne counties will be continued by E. R. Faribault. W. A. Bell will complete the investigation and areal mapping of the Windsor and Horton series in the vicinity of Windsor, Nova Scotia and a palaeontological study of the Windsor and Point Edward series between St. Ann Harbor and Glace Bay, will be carried on by J. E. Hyde. J. W. Goldthwait will continue a physiographical survey of Nova Scotia, giving particular attention to problems arising from glaciation. F. H. McLearn will complete a field study of the Silurian system at Arisaig.

In New Brunswick, A. O. Hayes will complete his work in the St. John area, making a special study of materials suitable for building stone and road metal. The mapping of the Moncton area will be completed by W. J. Wright, who will investigate the geological relations of the oil shales and make a study of the gas and oil fields. Palaeontological investigations will be conducted in the Maritime Provinces, Quebec and Ontario by E. M. Kindle, and in Quebec and New Brunswick by L. D. Burling.

In Quebec both exploratory and detailed work will be carried on. H. C. Cooke will explore Broadback river from Evans lake to James bay, including the route between Evans and Gull lakes. R. Harvie will complete a geological section across Brome county and make a general reconnaissance of the serpentine belt of the Eastern Townships. M. E. Wilson will continue the study of the geology of the Buckingham district, giving special attention to the deposits of graphite, apatite and mica. The geology of Mount Royal tunnel will be further studied by J. A. Bancroft. The economic possibilities of the granites of the south-eastern part of the Eastern Townships will be investigated by A. Mailhiot and a geological reconnaissance of a part of the Harricanaw basin will be made by T. L. Tanton.

In Ontario an examination will be made of the iron deposits of the township of Lount by W. H. Collins, who will also make a study of the Pre-Cambrian formations between Sudbury and Lake Huron. W. A. Johnston will complete the mapping of the Lake Simcoe district and of the calcareous drift areas between Rainy lake and Lake of the Woods. J. Keele and N. B. Davies will carry on investigations of the clay and shale deposits of Ontario with relation to the industries based upon these. The investigation of materials suitable for road metal will be in charge of L. Reinecke, who will confine his attention this year principally to occurrences in Ontario and Quebec. M. Y. Williams will continue a study of the Silurian rocks of south-western Ontario, giving special attention to those formations important in the manufacture of cement, lime, building stone and road metal. Certain mineral areas of Ontario, Quebec and the Maritime Provinces will be examined by S. Brunton and C. W. Robinson, and search will be made for radio-active minerals.

Exploratory reconnaissance and detailed work will be conducted in the prairie Provinces. C. Camsell will make an exploratory geological traverse between Black bay on Lake Athabaska and Christie bay on Great Slave lake. D. B. Dowling will make general examinations of the coal deposits of western Canada, while B. Rose will study the coal deposits, the clays and the sands of southern Saskatchewan. A geological reconnaissance of a belt along the north shore of Lake Athabaska will be made by F. J. Alcock, and special attention will be devoted to areas of probable economic importance. The area of the reported gold discoveries in the vicinity of Lake Amisk will be examined by E. L. Bruce, who will make a reconnaissance of the belt of country extending east from Lake Amisk to the Hudson Bay Railway. A. MacLean will map the Pembina mountain area in south-western Manitoba, while R. C. Wallace will complete his investigation of the gypsum deposits and associated minerals and springs of this Province. Geological investigations have been carried on for some time by S. E. Slipper in the Sheep River area south-west of Calgary, where boring operations are being actively prosecuted. These investigations will be continued and areal mapping undertaken. Charles H. Sternberg and his sons, collectors and preparators in vertebrate palaeontology, will be collecting vertebrate fossils again this year, probably from the Belly river formation on Red Deer river.

J. A. Allan will complete geological field work in the Rocky Mountain park and along the main line of the Canadian Pacific Railway between Banff and Golden. A general geological reconnaissance in Yukon territory, between Dalton Post and Canyon City, including the Lake Aishilik country will be made by D. D. Cairnes, and a more detailed examination will be made of all promising mineral localities. C. W. Drysdale will study the ore deposits of Ymir camp and do some preliminary work in the silver-lead area of the Windermere district. The investigation of the coal deposits of Graham island will be completed by J. D. MacKenzie, who will also map the Flathead coal basin. R. G. McConnell will be engaged in mapping and conducting geological investigations along the Grand Trunk Pacific Railway in the Hazelton-Aldermere district. A detailed examination of the Mesozoic formations along the Crowsnest branch of the Canadian Pacific Railway will be made by F. H. MacLearn. S. J. Schofield will complete the mapping of the area between the Cranbrook map and Kootenay lake, and will study the silver-lead ore bodies at Ainsworth and the recently discovered tin deposit in the Lardeau district. J. S. Stewart will map the coal-bearing formations comprised in the Flathead and Crowsnest map sheets.

Topography.

Under the direction of W. H. Boyd, chief topographer, topographical mapping will be carried on at various points throughout the country.

Certain pieces of work that were initiated last year will be carried to completion. These are the New Glasgow map sheet, by B. R. MacKay, on a scale of 2,000 ft. to 1 in. and a contour interval of 10 ft.; the Thetford map sheet, by D. A. Nichols, on a scale of 1 mile to 1 in. and a contour interval of 20 ft.; and the Flathead sheet, by A. C. T. Sheppard. S. C. McLean

will complete the Similkameen triangulation via Okanagan lake to the Railway Belt triangulation by the Department of the Interior. This gives the first triangulation connection between the International boundary and the main line of the Canadian Pacific Railway, and furnishes the control for surveys in the Similkameen and Okanagan districts.

Considerable new topographic work is being undertaken. A control traverse is being run by S. C. McLean in southern Nova Scotia. A. G. Haultain will make a transit and micrometer eye-piece survey of Lake Athabaska on a scale of 4 miles to 1 inch. This survey will serve as the hub control for all exploratory surveys in the surrounding country. Mapping of the Sheep river area on a scale of 1 mile to 1 in. and a contour interval of 10 ft. will be done by E. E. Freeland. This includes townships 19 and 20, and the southern third of 21 in ranges 2 and 3 west of the fifth meridian, the area in which boring operations are being actively prosecuted. A. C. T. Sheppard will map in the Crowsnest district an area of 1,500 square miles lying between longitudes 114° and 115° and latitudes 49° 30′ and 50°. The mapping of 1,500 square miles lying between longitudes 118° and 119° and latitudes 51° and 51° 30′, and including the portion of the Columbia River valley between Revelstoke and Downie creek, as well as the valley of Jordan river will be done by F. S. Falconer. W. E. Lawson will survey 1,000 square miles of an area extending from the British Columbia Alaska boundary in a direction parallel to Chilkat river and embracing the valley of this river and Rainy Hollow. The northeast corner of the sheet will extend into Yukon.

Botany and Zoology.

Botanical work will be done on Vancouver Island and on islands in the Gulf of Georgia by John Macoun and J. M. Macoun. P. A. Taverner and C. H. Young will study the life and conditions of the fauna of the Maritime Provinces and make collections for scientific studies and exhibition in the museum. During the summer advantage will be taken of an order made by the Department of Marine and Fisheries, to scale Perce-Rock, Gaspe peninsula. Perce-Rock is probably one of the few undisturbed breeding grounds of the gannet in America, and there is no authentic record that this rock has ever been scaled. Francis Harper will accompany an exploratory expedition into the country between Athabaska and Great Slave lakes under the leadership of C. Camsell. This will be a new field for zoological study. C. L. Patch will do some collecting in the vicinity of Ottawa.

Anthropology and Archaeology.

The field parties of this division will be widely distributed throughout the country. E. Sapir, the chief anthropologist, C. M. Barbeau and F. W. Waugh will in addition to completing certain reports, attending to office routine and museum work, make occasional field trips. Field work will be conducted among the Ojibways of Ontario and Manitoba, the Sioux of Manitoba, the Iroquois of Ontario and Quebec by Paul Radin, W. D. Wallis and F. H. J. Knowles respectively. A. A. Goldenweiser will carry on work among the Iroquois of Ontario, and E. W. Hawkes among the Eskimos of Labrador. A study will probably be made of the Micmacs of the Maritime Provinces by W. H. Mechling, while J. A. Teit will carry on work among the Interior Salish and Northern Athapaskan of British Columbia.

Harlan I. Smith, archaeologist, will carry on intensive exploration in the shell-heaps of Merigomish, Nova Scotia, where important results are anticipated, especially since the country lying around the Gulf of St. Lawrence was formerly inhabited by no less than four totally different peoples. W. B. Nickerson will continue explorations in the mounds, earth works and village sites of south-western Manitoba, and W. J. Wintemberg will explore a section of country between Prescott and Peterborough for a site of a culture different from that of more easterly parts of Ontario.

PETERSON LAKE ANNUAL REPORT

The eighth annual report of the Peterson Lake Silver Cobalt Mining Company, covering the financial year ending April 30th, 1914, is the most satisfactory yet presented. The company made a profit of $167,377.76 during the year. The cash balance on hand is $209,-24555, and the balance of assets is $246,938.20.

Income from royalties during the year amounted to $181,824.89. Ore bagged is estimated at $18,000. Interest and rent brought in $7,541.39.

Expenditures included: Mining and supplies, $15,-691.87; power and light, $5,259.49; depreciation written off, $11,663.99; other expenses, $7,373.17.

Mr. R. B. Lamb, consulting engineer says of the vein discovered at No. 2 shaft in January:

"The work of re-equipping and unwatering No. 2 shaft was commenced December 1st, 1913, and actual development work started January 21st, 1914. Both surface and underground equipment is adequate for the present. Later on it may be advisable to enlarge the rock house and install additional dressing machinery in order to recover the silver in the fines from the bumping table. The cost of equipping this property was $5,645.00, for hoist, pumps, drills and drill steel, pipe and fittings, cars, tracks, cage, ore scales, etc., including also the erection of a new change and ore storage house. In addition to unwatering and cleaning up the mine, installing necessary pumps, water and air pipes, new guides in the shaft, track, switches and otherwise putting the mine into proper working condition, the station at the 200 ft. level has been widened and double-tracked to facilitate handling the cars; suitable ventilating pipes carried to all headings and electric lights installed on the station and at switches along the main crosscut. A concrete dam has been built in front of the winze from the 200 to the 300 ft. level, the hoist chamber enlarged and winze re-timbered part of the way, thus putting it into proper order to resume work on the third level at short notice.

"When the company commenced work on the No. 7 vein, the upper part of the drift was in conglomerate. After seventeen feet of driving an oreshoot was encountered on January 31st. The first sample assayed 69 oz. silver. After the next round it assayed 141 oz., and after the succeeding round 1,506 oz. The average is over 1,300 oz. The first thirty feet of driving on the vein was in the conglomerate-Keewatin contact. This indicates that the contact is somewhat flatter than was expected. Twenty feet after striking the oreshoot the vein split. The branch which continued along the original strike carried silver in niccolite for twenty-one feet. The vein was followed for fourteen feet beyond the point where the values ceased when a water seam was cut and the vein disappeared. The other branch turned south and it is from this portion that the greater part of the ore has been mined to date. The ore proved to be 110 ft. long in the drift.

"The vein is irregular as to width and values; sometimes two or three stringers half an inch to an inch in width showing; at other points a solid vein of one and a half inches to three and a half inches wide is found. The principal mineral along this branch is smaltite, although niccolite stringers have frequently been encountered crossing the smaltite vein. In drifting, three mineralized cross stringers were cut. These were at twenty-two feet, forty-eight feet and fifty-six feet, respectively, from the split in the main vein. The first and third were followed as far as the mineralization persisted; the first to the east for twelve feet and the third ten feet to the east and fourteen feet to the west. Drifting will be continued on this stringer west. Where the third stringer crosses the vein we are now sinking a winze.

"The main vein was stoped an average height of twelve feet for a length of 120 ft., making 1,440 square ft. stoped on the vein. The ore in the stope has been patchy. We may be near the top of the shoot. The best ore is in the drift under foot. The stope has produced 25 tons of ore of an estimated value of 1,300 oz. per ton, and 2 tons of an assay value of 200 oz.

"On April 28th we encountered a second oreshoot in No. 7 Drift, 35 ft. south of the shoot just described. The vein is regular and an average of two inches wide. Too little development has been done to say more about it."

RUSSIAN ASBESTOS.

While the Canadian production of asbestos seems to grow steadily at an almost equal pace, the production of the Russian production in lagging behind its regular rate of increase. Last year's production in the Urals was 1,033,003 poods as against 1,007,679 poods in the year 1912. There is a hesitancy on the part of the Russian producers of asbestos and it is difficult to see the cause for this. The Canadian asbestos is in good demand and judging from reliable information it appears that the Canadian producers hesitate to contract for the delivery of large orders as prices are gradually upwards. Some years ago it was predicted that the Russian on account of its lower production costs would gradually replace the Canadian variety but it seems now pretty well established that the latter is far superior for the manufacture of certain articles than the Russian.

The production of Russian asbestos has steadily increased since 1889. From monograph of Asbestos, its occurrence, mining, milling and uses by Mr. Fritz Cirkel, as the following table will show:—

1889:—	1,850	poods
1893 —	64,654	poods
1899 —	164,430	poods
1906 —	494,680	poods
1908 —	9,500	tons (gross)
1912:—	1,007,679	poods=28,000 tons
1913 —	1,033,003	poods=28,700 tons

(1 pood=36 pounds)

GRANBY.

Granby directors have declared the regular quarterly dividend of $1.50 to be paid June 15 to stockholders on record May 29.

OIL DISCOVERED AT GREAT DEPTH IN ALBERTA

Calgary, Alta., May 16.—Calgary is in the throes of an oil fever. Speculation in oil leases and shares reached a tremendous pitch last night and the only topic of conversation continues to be on the oil strike. The scene at the well was one never to be forgotten. From early morning till after dusk a constant stream of automobiles kept arriving and leaving and it is estimated that over 5,000 people visited the scene of the discovery yesterday.

During the forenoon the well became an intermittent gusher. This was caused by the oil rising inside the bore to a certain height when it was expelled with great violence by gas pressure. The result was that spouts of the highest grade oil were thrown 50 to 60 feet in the air. The casing was capped for a time until a supply of barrels and tanks could be procured from Calgary. On removing the cap the oil again spouted about sixty feet, then subsided and the operators managed to suppress the spouting by constant baling. This, however, failed to reduce the level of oil below a certain height and there always was a depth of 1,760 feet standing in the eight inch casing.

The following analysis was made yesterday by the Kelso Laboratories, of this city: "The oil encountered is 65 degrees baume. Evidently exceptionally high gasoline, containing lighter petroleum ethers, etc. paraffine base. Slightly lower gravity than first oil discovered, which was 62.5 degrees. This oil probably much the same, though there may be more petroleum there and also more kerosene. Oil contains large volume of dissolved gas while original contained very little."

Nearly all the prominent local business men and financiers were at the scene of the discovery throughout the afternoon and everyone expressed the greatest enthusiasm and confidence in the future of the field. W. S. Herron, pioneer of the Alberta oil fields, and owner of one-quarter of the entire section in the Calgary Petroleum Products Company, owners of "Discovery" well, was naturally elated when interviewed this evening. He was standing watching the operations. Oil was being brought up by the baler as quickly as machinery could be worked. Congratulations were being showered upon him that his assertion had been proved, and nature forced to yield up her liquid wealth.

"This is only the beginning," he said, "and I firmly believe that similar wells will be found along this anticline to the south for 20 miles, as I have found similar gas escapes there to that which I discovered on the right of this well. On the same anticline running northwest I have no doubt that oil will also be found for even as great a distance. The oil is remarkable for its high quality and this indicates that it is coming from an immense reservoir of the cruder or heavier oil further down the slopes of the anticline and at a greater depth. As a matter of fact, the drill has merely touched the oil producing sands and I think that if the sands were penetrated a few feet the production would be greatly increased."

"Discovery" well is located on the northwest quarter of section six, township twenty, range two, west of the fifth meridian. There are now eight drills in operation in close proximity to the well and further developments may reveal themselves at any moment —Journal of Commerce.

PROGRESS IN NOVA SCOTIA MINING INDUSTRY IN 1913

By F. H. Sexton.

The present time may occasion some anxiety as to the markets of the immediate future, but none can deny that the year that has passed was a most prosperous one. According to the report of the Provincial Department of Works and Mines, the number of long tons of coal produced in Nova Scotia reached the grand total of 7,200,000. This is the high water mark so far in the history of coal mining in this province. The production exceeded that of 1912 by 400,000 tons, equivalent to an increase of 6 per cent. The coal output in 1913 exceeds that of a decade ago by nearly 2,000,000 tons, equivalent to an increase of nearly 40 per cent.

There are two regretted features in the mining industry of the province during the year that has passed. I refer to the recession in the gold production, and to the increase in the number of fatalities in the coal mines. The value of the gold won last year has dropped to one third of what it was in the first year, for which we have official returns, viz.,—1862. The reasons for this condition are not as clear as might be wished. We have an enormous area of gold bearing measures, nearly five thousand square miles. Much of this ground is virgin at the present time. From the beginning of gold mining in Nova Scotia in 1862, to the present time, over 2,000,000 tons of rock has been crushed, yielding over 915,000 ounces of the precious metal, an average of about $9.00 per ton in value. Many large mines in the world have a long and profitable history where the amount of gold per ton extracted is less than a third of the average value of our ore. Our prospectors and miners are noted for their hardiness, intelligence, and ability, and have been placed in responsible and lucrative positions wherever they may have wandered away from their native province. The gold is easily extracted from our ores by the simple process of amalgamation. Our gold bearing districts, except in few instances, have never been prospected with even a small portion of the thoroughness of great areas of barren country in Ontario. It is common knowledge among our prospectors, that many trails of golden boulders in the glacial drift have never been followed to the rich leads from which the ore was torn.

A great portion of our prospectors and gold miners have followed the lure of distant fields, and are now in Cobalt, Porcupine, or other great silver and gold camps. One great successful mine attracts capital as honey draws flies, and we must admit that we have never had a gold mine whose name has become world-famous. Our gold veins are usually comparatively narrow where valuable ore shoots occur. The shoots themselves, although persisting in some cases to a depth of 1,000 ft., are often short along the strike of the vein. All the diagnosticians of the present depression in gold mining are not unanimous in their conclusions, nor do all propose the same remedies. Some say that a new era of prosperity will dawn with the advent of cheap power, some assert that drastic changes must be forthcoming in legislation concerning mineral leases, some maintain that provincial subsidies for development are essential, others declare that efficient management, and the application of the newer developments in mining machinery and metallurgical processes will solve the problem. It would seem that the whole question was in a state where it could profit by the intelligent study of a competent commission.

The case is not hopeless, and the future is not altogether gloomy. There is a general conviction among our gold miners that the most profitable form of exploitation of our gold deposits will be on a modest scale with a small company. The idea of treating vast low grade deposits in Nova Scotia on a huge scale has almost disappeared. There is a belief that there are many opportunities for handsome profits for the small company which will find the ore shoots and stick to them, if it is economically and efficiently managed. There is a much larger number of such enterprises entering upon extensive operations at the present time than there was a few months ago. The Halifax and Eastern Railway will improve the transportation facilities in a large gold-bearing district which it penetrates. A number of mine managers and miners have returned to the province from other mining camps, convinced that the possibilities in gold mining at home are quite as good as in many other places of much more general repute. Altogether, the outlook for a sane development of our potentialities in this branch of industry, is distinctly encouraging.

Of the increase in fatalities in our coal mines, I will have little to say, because a number of gentlemen, more competent to discuss this, will take up the matter fully in papers which they have prepared on this subject. Most of the accidents were individual cases, i.e., there was no explosion of gas or other serious calamity which involved the death of more than one person. It is perhaps noteworthy that nearly one half of the fatalities occurred to men who were not of Anglo-Saxon extraction. There was a larger percentage of deaths in the mine among those of Latin origin in comparison with the number employed, than among natives and British-born.

I wish to call attention to the fact that our vast riches in non-metallic deposits, such as gypsum, clays, barytes, limestone, and silica, are receiving more attention than has heretofore been the case. We have exported most of these products in the crude state, but with each succeeding year progress is made in erecting plants to convert these materials into various manufactured articles. Our rich heritage in deposits of limestones, gypsum, barytes, etc., will some day form the basis of an immense, staple and profitable industry. Speed the day when this consummation is manifest.

Last summer we were favored by a visit from many distinguished foreigners, who came to Nova Scotia on an excursion of the International Geological Congress. The arrangements of the trip to the Maritime Provinces had been exhaustively planned by the Canadian Geological Survey, so that everything slipped along to the casual observer like a smooth-working automatic machine responding to the plans of its inventor. We were delighted to entertain the visitors, and trust that their memories of this excursion be only half as pleasant as our own. We wish to commend Mr. Brock and his assistants for the truly admirable manner in which the whole affair was conducted, and especially for the wealth and utility of information of the guide books applying to this part of the country, which should be of great value for a long time to come.

Extracts from presidential address, Nova Scotia Mining Society, April 15, 1914.

We all welcome the recent humanitarian invasion of industry. Of course, the economical phase of a "safety first" movement is evident to any on-looker. But I am glad to believe that the root of this spirit is humanitarian and Christian rather than financial. No man, not even the driver or the trapper, would exchange his life for 150,000 tons of coal, which is about the toll that was taken last year. Absentee directors and stockholders are becoming, or have become, convinced that superintendents and managers of coal mines should not be submitted to such pressure for high production and low cost, as to neglect any safeguard which will preserve the safety and well-being of those who toil below ground. There is a fine spirit abroad, that even those who have only a financial interest in the mining industry are the trustees of the human welfare of those who assist with labor in profitably exploiting our mineral deposits. The great expansion in various efforts of mining corporations in safety devices, improved hygiene, profit-sharing, hospitals, wash houses, libraries, mine rescue apparatus first aid instruction, benefit associations, pensions, improved housing, education, and recreation facilities are manifestations of the fundamental spirit of christian civilization expressed in the phrase "I am my brother's keeper."

I cannot let this occasion pass without making some slight reference to the gallant conduct of inspectors mine officials, and miners in several trying underground fires during the past year.

The golden age of heroism and chivalry is not gone The world is just as rich in courage as ever it was. The fine spirit remains, only the manner and conditions under which it blossoms are transformed. This was exemplified several times last year, when our men were called upon to fight fires underground. Here amidst huge volumes of smoke and poisonous gases, burning coal, and red hot rocks encased in oxygen helmets, and cooled by streams of water from a rear guard in similar helmets, ever in danger of an insidious unseen foe which might blow them to perdition at any moment they fought day and night to save the property of their company, to safeguard their means of livelihood, and to preserve one of the heritages of our people. We cannot accord such valor too high an honor.

SLOCAN.

From the time work was resumed at the Rambler-Cariboo mine and concentrating mill late in April until the middle of May, there have been shipped to the smelting works at Trail two cars of silver-lead crude ore and two cars of concentrate. One car of zinc concentrate is at the mill ready for shipment to Bartlesville, Oklahoma. About 45 men are employed at mine and mill; it is expected that shortly more men may be employed to advantage.

Repairs and improvements to the wagon road from near Cody to Sandon have been commenced in preparation for ore-hauling by teams. Ore from the Surprise Mine is being sent down by aerial tramway to the wagon road, whence four-horse teams will take it to the railway terminus at Sandon. Beside the silver-lead ore, which is shipped to Trail for reduction, there is zinc ore in both the Surprise and Noble Five group mines, near Cody. Nearer Sandon are the Slocan Star, Ruth-Hope group, and Richmond-Eureka group, all of which will ship ore. Now that the roads down to the railway are clear of snow, hauling from the Star and Hope can be resumed. The Richmond-Eureka has aerial tramway connection between mine and railway. Developments in the long low-level tunnel in the Payne property are reported to be encouraging, for while the ore lately found at considerable depth is as yet only in very small quantity, it has a high value in silver.

OIL DRILLERS BUSY.

Calgary, May 22.—In addition to "Discovery" well, which is located on section 6, township 20, range 2, west of the fifth meridian, where the oil strike was made last Thursday night, there are no less than eight wells drilling in the same locality.

The great rush of people eager to purchase shares in these companies at prices ranging from par to 500 above, has furnished the necessary capital in astonishing rapidity and drilling will be conducted with feverish activity from now on. Other wells have been located and within three months the whole strip of land will be dotted with derricks. For the information of those interested in oil developments the following will prove of interest.

Depth of Wells Now Drilling.

West of the Fifth Meridian.

Company.	Depth.
Calgary Petroleum (Discovery)	2,718 ft.
McDougall Segur Exploration	2,402 ft.
Black Diamond Oil Fields	1,575 ft.
United Oils, Ltd.	1,282 ft.
British Alberta	1,000 ft.
Western Pacific	300 ft.
Southern Alberta	800 ft.
West of the Fourth Meridian.	
Federal Oil & Gas, Corporation	482 ft.
Monarch Oil Company, west of Olds	200 ft.

THE ANGLO-FRENCH EXPLORATION CO.

The Anglo-French Exploration Company, Limited, capitalized at £15,000,000 and possessing assets of £1,028,660 in the form of holdings of stocks, shares and debentures, has issued its report for the year 1913. Of the thirty-three principal companies in which interests are held, twenty-seven paid or declared dividends during the year. Railway and mining company stocks, shares and debentures are the principal holdings.

In Canada the company's chief asset is 20,000 shares of Hollinger Gold Mines, Limited.

The directors of the Anglo-French Exploration Company are F. A. Robinson, Wm. Freehville, Ernest G. Moeatta, Louis Ochs, Edward Wagg, Wm. Henderson Clark, and W. Dalrymple.

Geo. R. Airth is manager in London, J. A. P. Gibb is advisory engineer in South Africa.

In Canada the company is represented by J. B. Tyrrell, Toronto.

BRAZEAU COLLIERIES.

Martin Nordegg, vice-president of the Brazeau collieries, in the foothills of the Rockies, west of Edmonton, announces that the company has control of some 20,000 acres of coal lands, 200 men at work in the mines and that the output of the Nordegg field will eventually reach 2,000 tons a day. A town will be established by the company and houses are to be built for the miners and their families. The Canadian Northern Railway Company is building a line to the Brazeau coal country from its Vegreville-Calgary line, via Red Deer.—Financial Times.

RELATION OF GEOLOGY TO MINING

By F. H. Hatch.

The delivery of the presidential address to the Institution of Mining and Metallurgy affords an opportunity which is in some respects unique. For, not only is the choice of subject unfettered, but the occasion is privileged in so far as it is exempt from discussion; and the calling of a temporary halt in the consideration of topics of more immediate interest provides an interval for taking stock in some one of the numerous provinces of our many-sided profession, for reviewing its recent progress, appreciating its present position, and forecasting its future development.

This being conceded, the incoming president will naturally choose his subject from the department with which his work has been more particularly connected. Since in my career as a mining engineer a knowledge of geology has stood me in good stead, I cannot do better than choose as the subject of my address the Relation of Geology to Mining.

Geology was founded to a large extent on the observations of the miner.—The primary geological conceptions, such as outcrop, strike, dip, hanging wall and foot wall, together with a wealth of mineralogical and petrological detail, were furnished by the work of the early metal miner; while the close study of the bedding relations of the coal seams which their profitable extraction demanded, formed the basis of modern stratigraphy. The earlier geologists acknowledged their debt to mining. But to-day the positions are reversed; mining is in debt to geology. Thus, by the application of geological principles, valuable seams and lodes, even when disturbed by igneous intrusions or dislocated by faulting, are traced far beyond their first known outcrops, and facts bearing on their downward extension are scientifically interpreted; while detailed geological surveys of mining districts are of the greatest service to prospectors, and sometimes lead to entirely new discoveries. To-day, on the great iron and copper mines of the United States, not only are geologists retained to study the deposits, but the exploratory work is often committed to their care. By means of a system of routine work, successfully organized on some of these mines, veins and ore shoots are correlated from level to level; raises, crosscuts and pump stations are located in the positions most suitable to geological conditions; and ore bodies lost in faulted country are recovered, the fault-displacement being determined quantitatively and allowed for in subsequent development work on lower levels.

Specific instances of the successful application of geological knowledge to mining work can, of course, be given in abundance; but a few must suffice for the present purpose.

In this country the proving of the underground extension of the coal fields beneath the younger rocks surrounding them is of paramount importance to its industrial welfare. One of the first pieces of work in this direction resulted from the admirable mapping of the Midland coal field by Beete Jukes, a distinguished member of the Geological Survey of England and Wales. The entire correctness of his theories was demonstrated by Henry Johnson in a deep sinking at Sandwell Park when the first definite proof was furnished of the prolongation of the South Staffordshire coal field to the east under the fringe of overlying red rocks.

Similarly the discovery of a buried coal field in the south-east of England was the direct result of a piece of pure scientific deduction. Godwin-Austen argued that the tectonic folds in the Palaeozoic floor, by which the existence of coal basins are determined, would be traceable even when covered by a great thickness of newer rocks, because a line of disturbance, whether of faulting or folding, when once established, tends to be the locus of subsequent movement and thus to set its mark on the newer strata. The correctness of this tectonic principle was demonstrated by the successful borings carried out in the neighborhood of Dover, first by Sir Edward Watkin and later by the Burr companies under the scientific advice of Prof. W. Boyd Dawkins and other geologists. These borings showed that deeply-buried under Mesozoic and Tertiary strata is a coal field, situated on the line connecting the seams worked in Northern France and Belgium with those of South Wales and Bristol; and it appears not improbable that other coal areas might be found, if the underground geology of this line of country were systematically explored. A satisfactory feature of the discovery of buried coal fields in England is the large addition thereby made to our coal resources, as to which previous estimates had been rather pessimistic.

Another striking instance of the successful application of geology to mining is furnished by the tracing eastward and southward of the sub-outcrop or apex of the Rand banket formation under a cover of up to 1,200 ft. of later unconformable beds. The investigations that led to this result were based on a geological survey of the country between Boksburg, the Springs and Heidelberg, the first results of which made it probable to me that the Van Ryn conglomerate, which disappears near the Springs beneath the Karroo coal measures, and the Nigel conglomerate, emerging therefrom near Heidelberg, were geologically identical, although separated by a large area in which dolomite and coal measures from the surface. As my work progressed, the supposition that the two outcrops with their opposed dips were respectively the northern and southern lips of a large but shallow synclinal basin became almost a certainty, and deep borings made in the intervening country confirmed in the end the correctness of the theory in the most satisfactory manner.

The successful outcome of these investigations added to the Witwatersrand gold field an enormous area of mining ground in which the banket is not too deep for exploitation, should its average gold-content prove high enough to enable it to be profitably extracted—a consummation, of course, devoutly to be wished, but only demonstrable by shaft-sinking and development, since the assay results of bore-hole cores are no guide to average values. The deepest bore-hole of the series under my immediate supervision, namely, that put down on the boundary of the farms Grootvlei and Daggafontein, was practically on the axis of the syncline, and cut the "main reef" at a depth of 5,540 ft. (or corrected for deviation, 4,880 ft.). It passed through 1,140 ft. of dolomite before entering the Witwatersrand formation, but gave a most instructive section of the latter, intersecting the Kimberley, Bird, Modderfontein and Van Ryn or Main Reef series of conglomerates as well as their associated quartzites,

Extracts from presidential address, Institution of Mining and Metallurgy, London, Feb. 19, 1914.

slates and sheets of amygdaloidal diabase. At the time of the sinking the whole of the core, about a mile in length, was carefully labelled and preserved on the property in a specially constructed core house.

The limited time at my disposal will not allow me to recapitulate more than a few of the important services rendered in recent years to mining by geologists. But mention must be made of E. J. Dunn's and T. A. Rickard's work on the Bendigo gold fields and their exposition of the true nature of the remarkable saddle-reefs, whose tectonic structure has determined a type of mine development quite peculiar to that field.

Again, S. F. Emmons' monograph on the structure and genesis of the Leadville silver-lead ores has been of enormous value to the Colorado miners, not a few of whom owe their success on that field to the predictions of the distinguished economic geologist whose recent demise we must all deplore. On the other hand, the theory favored by Emmons that the ores were derived from metals leached from the overlying porphyries and the consequent conclusion that the lower limestone would on the whole be unproductive, have probably somewhat retarded the deeper development of the district. These lower horizons, however, have latterly proved to be very productive as will be shown in the new edition of the Leadville Monograph now in course of preparation. Emmons' researches on the deposits of silver-lead ore in limestone at Leadville incidentally led him to develop the theory of metasomatism, or replacement, as a prime factor in the genesis of ore deposits. Of this more anon.

Another worker in the same field, and, moreover, a friend of Emmons and long a colleague on the United States Geological Survey, is George F. Becker, whose classical studies on the famous Comstock lode and its high-temperature thermal springs have done so much to demonstrate the close genetic connection between ore deposition and vulcanicity. Becker's monograph on the geology of the Comstock lode was issued in 1882, and in one of the opening chapters he pays a remarkable tribute to Baron Ferdinand von Richthofen, who examined the Comstock in 1865 for the Sutro Tunnel Co., at that time engaged in driving a deep level adit to the lode at a depth over 1,000 ft. vertical below the then existing workings. The German geologist had a keen insight into structure, and although the mines were, when Becker wrote, about six times as deep as they were at the date of von Richthofen's report, the later investigator states that the opinions and predictions of his predecessor as to the behavior of the lode in depth had been verified in a very remarkable manner.

The United States not only is rich in great natural repositories of mineral wealth, but is fortunate in its economic geologists, whose keen observation and powers of deductive reasoning are admirably adapted to the study of their structure and genesis. That this is no idle saying witness the splendid series of monographs and professional papers issued by the United States Geological Survey. I have referred to the work of Emmons and Becker; there are many others. To mention a few only: R. D. Irving, who wrote on the Copper-bearing Rocks of Lake Superior; Lindgren, on the Copper Deposits of the Clifton Morenci District, Arizona; Weed, on the Geology and Ore Deposits of the Butte District, Montana; Lindgren and Ransome, on the Geology and Gold Deposits of the Cripple Creek District, Colorado; Van Hise and Leith, on the Iron Ore Deposits of Lake Superior.

Willet G. Miller's work in the Cobalt silver district also deserves mention. His description of the characteristic features of the silver veins right at the beginning of the mining operations of that camp was of first importance; and his early recognition of the bearing of the Keewatin series, which underlies the Cobalt conglomerates, on the life of the mines exercised a salutary chastening influence.

The laborious nature of the task of collecting and collating the material for memoirs such as these is well illustrated by the introductory remarks to Mr. Weed's Butte paper. The complexity of the geological structure of the Butte district necessitating very detailed observations; "in every mine, maps of each level were transferred to notebooks, and with these in hand the writer and his assistants carefully examined the drifts and crosscuts and plotted on the maps the occurrences of each slip, vein or fault, noting the dips, strikes and other important features. Stopes and raises were noted in the same way and sketches made of particular features of vein structure and ore occurrence." Over a hundred miles of underground workings were examined in this manner.

Hitherto I have confined my remarks to lode mining; but in the field of alluvial mining the economic geologist has also something to say. The fascinating task of tracing out, first by boring and then by drifting, the auriferous gravels of an ancient river system, deeply buried under a pile of more recent accumulations, which sometimes even include thick sheets of basaltic lava as in the Loddon valley at Ballarat, must have called for considerable geological acumen. I am unaware to whom the credit for the first discoveries of this nature in Australia and California is mainly due, but mention must be made of the work of Reginald A. F. Murray in Victoria and of R. L. Dunn and Ross E. Browne in California. I should also like to direct attention to Lindgren's remarkable reconstruction of the ancient (Tertiary) topography in the vicinity of Nevada City and Grass Valley in California.

The assistance rendered by geologists in prospecting for petroleum is well known to you. The earliest investigations of petroleum fields, dating back to the middle of last century, led to the conclusion that great natural reservoirs of oil and gas tend to form along the axes of anticlinal folds or at the top of domes; it was also observed that the best conditions for oil accumulation were those of gentle folding, sufficient indeed to give a gradient along which the oil and gas could travel in the porous bed, but not intense enough to cause fissuring in the impermeable cover. It must be conceded that the general correctness of this theory has been confirmed by the work of subsequent observers, and it will also be noted that the "anticlinal theory" is not quite as novel a conception as some of our friends would have us believe.

There can be no doubt that the search for these natural products is essentially a geological problem, and, to my mind, the fundamental qualifications for what is euphemistically termed "the oil expert" are sound geology and common sense.

I shall refer later on to the important bearing on mining—especially on the mining of copper—of the researches of mining geologists on the origin of ore deposits, and notably in regard to the phenomenon of secondary enrichment.

Enough has been said to indicate the dependence of mining on geology; but that this dependence is not universally admitted is evidenced by the prejudice against both the mining geologist and the scientifically

trained engineer occasionally found among mining employers by whom they are sometimes unfavorably compared with the so-called "practical miner." Rule of thumb methods, however, in either mine valuation or exploratory and development work can never command success; indeed, the unschooled miner often enough realizes the value of geology and sets about acquiring such a working knowledge of its principles as will enable him to tackle the more prominent tectonic troubles met with in sinking or drifting. But men of this stamp are the exception rather than the rule, and it is clear that, ceteris paribus, the trained man, who brings to mining problems a sound knowledge of the principles underlying their engineering and geological aspects, not only starts with a pronounced advantage, but is enabled to assimilate practical details with far greater rapidity and certainty when once his mining career has commenced.

The feeling amounting even to suspicion with which geology is in some quarters regarded, is, perhaps, attributable to the following causes: First, there are the nonsensical reports on mines and mining prospects —such as most of us can recall—made by charlatans who, by the use of an obscure geological phraseology, seek to impose their trite conclusions on the credulity of their employers; then there are the wearisome lucubrations of the irresponsible faddist who uses the columns of the local press to ventilate his absurd geological theories. However, geology is not the only science to suffer from the ignoramus and the bore. A more serious disability perhaps lies in the employment in mining work of the academic geologist who has had no previous experience of mines and is unacquainted with mining conditions and economics. Imagine such a one—in his own province possibly a distinguished scientist—taken underground for the first time, groping his way in a murky atmosphere but dimly illumined by the miner's lamp or the glimmer of a candle, amid unfamiliar, and occasionally unpleasant, surroundings; imagine under such conditions his being asked to unravel the intricacies of a fault or to prognosticate the downward extension of an ore body. In fact, the lavish natural indications, which at the surface attract the attention of the geologist, tend at first to elude him when he penetrates beneath it; since there the exposures are few in number, and, such as they are, small; moreover, they are, as a rule, covered with dust, begrimed with soot or buried in mud. Even to overcome initial difficulties, such as these, is not enough; to achieve a real success the work of the miner must be followed step by step, since in his progress he effaces the facts almost as soon as they are disclosed.

Mining geology.—It must be abundantly clear that mining geology is a branch of the profession distinct from pure geology, and that proficiency in this specialized department cannot be attained without a proper training underground.

In the United States there is a growing tendency to differentiate the functions of the mining man; thus we find there an increasing use of the term "mining geologist" to designate a mining engineer strong on the geological side, or, what in practice amounts to the same thing, a geologist who has specialized in mining work. On the other hand, the term "mining engineer" is occasionally used rather in the restricted sense of a mechanical engineer who has specialized in mining machinery. Thus, Professor Munroe of the Columbia University, in contributing to the discussion of a paper read before this institution, said the mining engineer was called upon to design machinery for mining purposes and to superintend its construction and operation. He "should be able," he continued, "to test, among other things, the efficiency of boilers, steam and gas engines, air, hydraulic and other motors, pumps and compressors, electric lighting and power plants, telephone and telegraph systems, crushing, concentrating and amalgamating machinery and metallurgical plant, and to determine in each case whether the motive power, coal, gas, water, air or electric current, is economically used and the machines and mechanical devices are working to the best advantage. Or if this is not the case, he should be able to diagnose the trouble and indicate the remedy, and determine the conditions of maximum efficiency and economy." Surely in writing this Professor Munroe must have had in mind the application of mechanical engineering to mining, neglecting for the moment its exploratory side, for it is clear that mining consists of two distinct parts: (1) The exploration and development of the ore body; and (2) the extraction and bringing to the surface of the ore, the first being essentially a problem in which geological principles are dominant, while in the second, mechanical engineering plays the chief part.

It is evident that the examination of a supposed mining field, or of a lode or ore-body on which nothing but prospecting work has been done, is essentially the work of the mining geologist; and it may also be conceded that, provided he has served the requisite apprenticeship underground, understands the art of sampling, and can gauge with some approximation to accuracy the costs of mining and treatment, the inspection of a partially developed or "young" mine may also be properly entrusted to the mining geologist.

In the case of a fully developed mine, in which the whole, or practically the whole, of the available ore is blocked out for stoping, or at any rate is developed by drifts extending from end-line to end-line at the lowest levels permitted by the dip boundary of the property, the requirements are somewhat different. Here what is wanted is not so much the drawing of inferences from the geological environment of the ore, but a correct appraisement of the net profit obtainable by its extraction with due regard to the economic conditions prevailing. In this case, apart from the estimation of ore reserves, a consideration of the most suitable methods of extraction and treatment and questions of finance are of paramount importance. An actual apprenticeship in mine management, supplemented by a long experience of mine examination under the most varied conditions, are here the prime requisites for a successful valuation.

ALBERTA OIL COMPANIES.

Forty Alberta oil companies, incorporated since the discovery of oil in the Dingman well last week, have a total capitalization of $35,820,000.

The Board of Trade of Grand Forks, B.C., is urging the Provincial Government to repair the wagon road and bridges between the end of the railway at Lynch creek and Gloster camp, some 30 miles or more, a contract for hauling 1,000 tons of ore from the Union mine to the railway terminus having been let.

IRON ORE WASHING PLANTS

The occurrence in various parts of the United States and Canada of large bodies of iron ore too low in iron content to be smelted direct in the blast furnace at a

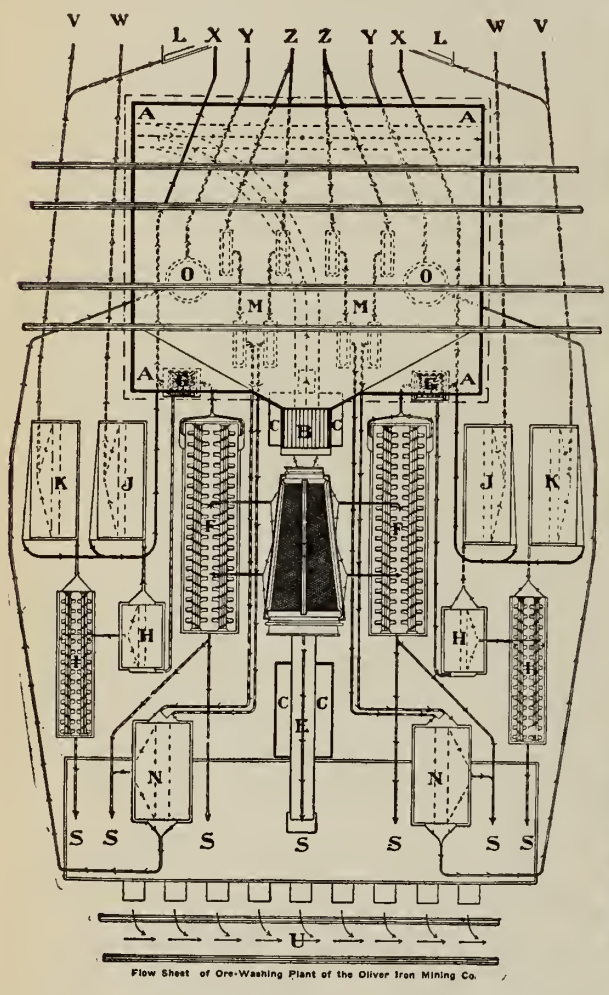


Fig. 1. Flowsheet of Iron Ore Washing Plant.

profit, is of great economic importance to these countries. Undoubtedly from these sources the future supply of this most important commodity will be drawn when the great bodies of high grade ore now furnishing the bulk of the raw material to the blast furnace are insufficient for the demand.

A—500-ton crude ore receiving bin; **B**—71in. grizzly bars; **C**—Rock pocket; **D**—20 ft. 2 in. perforated conical screen; **E**—3 ft. picking belt; **F**—25 ft. log washer; **G**—36 in. x 4 ft. perforated chip trommel; **H**—5 ft. x 8 ft. settling tank; **I**—18 ft. turbo washer; **J-K**—6 x 14 ft. settling tank; **L**—Overstrom tables; **M**—10 x 54 in. Frenier pumps; **N**—7 ft. x 12 ft. dewaterer; **O**—5 ft. x 6 ft. clear water tank; **S**—Shipping bin; **T**—Tail race; **U**—Shipping track; **V**—To first 5 Overstrom tables; **W**—To last 5 Overstrom tables; **X**—Overflow to waste; **Y**—Wash water; **Z**—Concentrates lifted by Frenier pumps to dewatering tanks.

The interest of the public in the conservation of natural resources and the interest of owners of such low grade ores is stimulated by the success of two milling plants installed on the Mesabi range in Minnesota for raising the grade of hitherto unprofitable ores. These mills are those of the Oliver Iron Mining Company near Coleraine, Minn. on the shore of Trout Lake, and of the Wisconsin Steel Company near Nashwauk, Minn. and a short distance from the shore of O'Brien Lake. The ores treated in both mills consist of a mechanical mixture of soft hematite and sand, with boulders of ore and paint rock and some clay, all loosely held together, and breaking up in handling.

The following description of the plant is from a bulletin issued by the Allis-Chalmers Co.:

The plant of the Oliver Company which treats upwards of 1000 tons per hour, is an example of conservative construction, a plant designed for long life

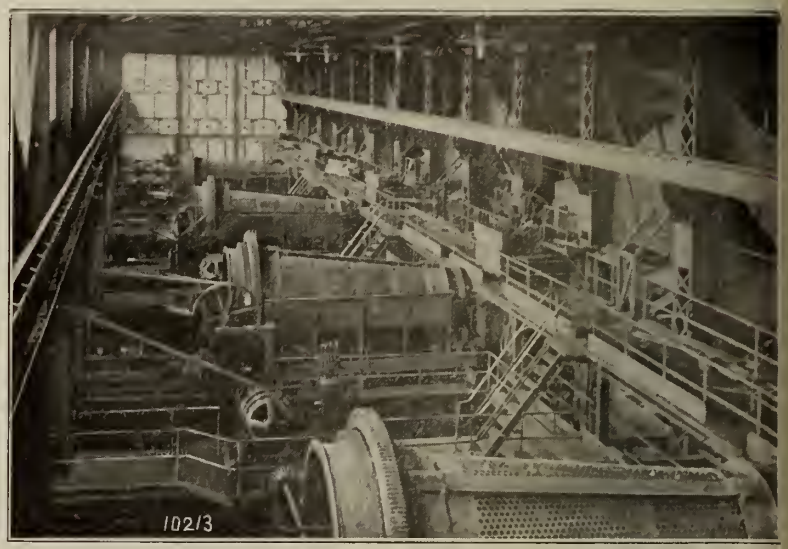
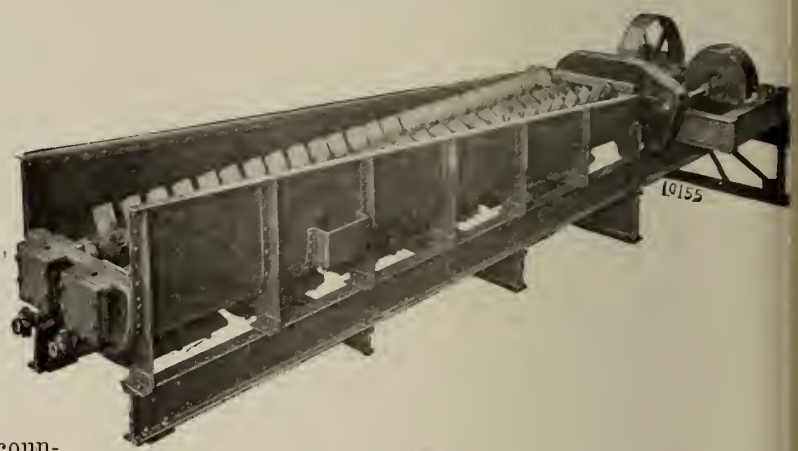


Fig. 2. Trommels, Oliver Plant.



Log Washer

with a consequently low depreciation and maintenance charge, for low operating costs, and for reliability. The accompanying flow-sheet, Fig. 1, shows the passage of the ore through a single unit of the mill, there being five similar units. The ore comes from several of the company's mines in the immediate neighborhood, and is hauled in trains of dump cars and discharged into the five-hundred ton receiving bin, Fig. 3, within the mill building. Leaving the ore bin "A" the ore flows over the grizzly "B", where a partial sorting takes place, waste being rejected into the pockets "C" and coarse ore being broken by hand to pass through the grizzly. The ore with the water used in sluicing it to the grizzly is fed into the revolving conical trommels "D", four feet in diameter at the feed end and tapering to a diameter of eight feet in a total length of twenty feet. These trommels, Fig. 2, are especially designed for iron washing service, very substantial in construction, carried on rollers so that there is an unobstructed opening through the trommel for the passage of the ore. It has few wearing parts and those capable of easy replacement, the screening surface is of perforated metal, which in this case has perforations two inches in diameter. After being washed by a

spray of water inside the trommel, the oversize is discharged onto a short belt conveyor, "E", from which the waste is sorted out and dropped into further waste bins "C", the coarse ore going over the end of the conveyor into the shipping bin "S". The undersize from the two inch holes of the trommel is divided between two twenty-five foot patented Turbo Log Washers, "F", the coarser and heavier particles which constitute the ore being pushed over the shallow end into the shipping bins, while the sand and clay together with the finer particles of ore are carried by the high velocity of the water over the overflow at the deep end and pass through a chip screen "G" and a settling or sloughing-tank "H", chips and water being eliminated. From the sloughing-off tank, the fine ore flows through the spigots to an eighteen foot Log Washer, "I", where the ore is again washed, concentrates being discharged over the shallow end into the shipping bin, and the overflow, which contains the finer sand and finer ore, goes to a settling tank. The overflow from the sloughing-off tank goes to a similar settling tank, the overflow from both settling tanks "J" and "K" going to waste. The slowly settled slimes in these tanks is discharged through bottom spigots and fed onto Overstrom Tables Fig F, of which there are twenty per unit, on which the final concentration is done, the tailings going to waste. The fine concentrates from these tables are elevated by Frenier sand pumps "M" to settling tanks "N", from which the concentrates as settled are drawn off into the shipping bins without excess water. The overflow from this tank is led to the tank "O" supplying the wash water for the dressing on the tables and thus is prevented from leaving the mill carrying any mineral of value. This small wash water supply tank has its level maintained automatically, fresh water from the supply lines being introduced for this purpose, constant head being thus maintained at the tables.

The ore coming from the mines runs from 35 per cent. to 50 per cent. iron, and is raised to an iron content of from 58 per cent. to 62 per cent. by the treatment in this mill, the final grade depending partly on the furnace requirements. For each unit there is installed a motor equipment totaling 135 horsepower, as follows: For the revolving trommel "D", the two 25 ft. Log Washers "F", the two 18 ft. Log Washers "I", and the Picking Belt "E", there is provided a 100 horsepower induction motor; for the twenty tables and the Chip Screens, a 15 horsepower induction motor; and for the eight Frenier sand pumps, a 20 horsepower motor. The water supply is pumped through a 30 in. main from Trout Lake, 1 1-4 miles distant, into an elevated storage tank of 100,000 gallons capacity, from which each unit receives its supply at 70 pounds pressure through a 14 in. main. There is provided for each unit a pumping capacity of 1700 gal. per minute when the complete plant is in operation.

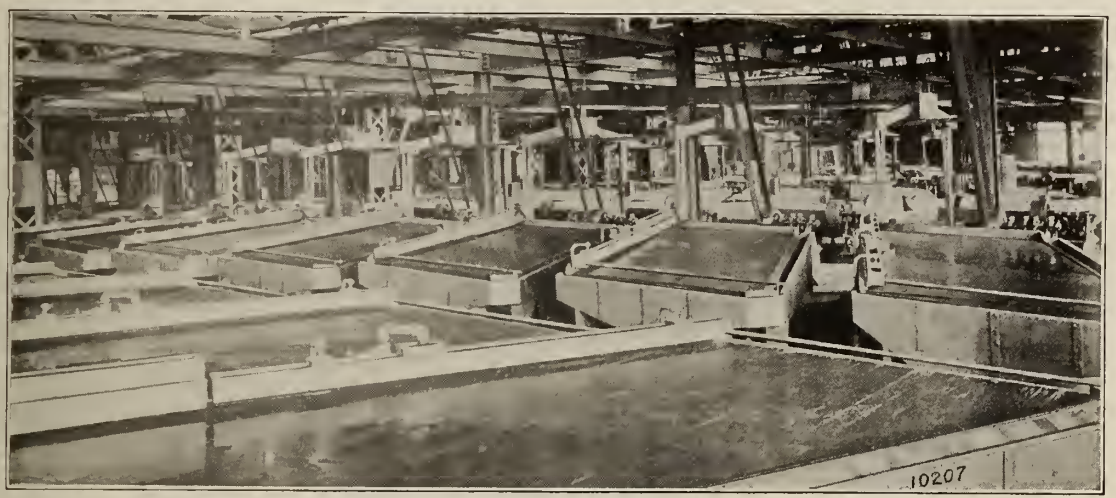


Fig. 3. Overstrom Tables, Oliver Plant.

This mill was built from plans of the Oliver Iron Milling Company and put into operation early in 1910 and is the result of experimenting dating from 1907 under the direction of John Uno Sebenius, chief mining engineer.

The success of this plant pointed the way for other mining companies having similar problems, and during the winter of 1911-12 there was constructed the plant of the Wisconsin Steel Company, built along the lines of the former plant, but with features of its own. It is built at an elevation of some 112 feet above O'Brien Lake, which will allow of a settling basin for the sands rejected by the plant and prevent them flowing into the lake.

Plant of the Wisconsin Steel Co.

This plant consists of a single unit at the present time, but provision is made for increasing the number of units when it becomes desirable. The ore coming from the company's open pit mines, where it is loaded by the steam shovels, is discharged from the cars into a steel bin of some 250 tons capacity. From this bin the ore is fed onto a long inclined conveyor, on which it is carried into the building and discharged onto a short grizzly, the grizzly openings being 9 3-4 in. centers. The oversize from the grizzly is rejected into the rock chute if waste, or broken to pass the grizzly if ore. All material passing the grizzly falls along a chute to the small end of a revolving conical trommel where it undergoes washing as well as screening. The oversize from the trommel falls onto a picking belt, from which the waste rock is sorted out, the ore being discharged by the conveyor into ore bin. The undersize from the trommels is divided between two 25 ft. Log Washers.

The mill machinery is driven by a 100 horsepower motor, this including one screen, two 25 foot washers and two 18-foot washers, and the picking belt. A 30-horsepower motor is used to drive the main conveyor,

which is 36 in. wide and 151 ft. long; a 20 horsepower slip-ring motor is used to operate the feeders under the ore bins.

The pumping unit in the power plant has a capacity of 2500 gal. per minute against a head of 250 ft., and is carried to the mill through a 16 in. main where it discharges into a storage tank having a capacity of 25,000 gal. This water is distributed within the mill at 40 lb. pressure.

The principal machinery in both of these plants and in the power plant as well, is the product of Allis-Chalmers Manufacturing Company. In the case of the Oliver Company, the generating unit is an engine driven alternator of 1200 K. W. capacity, supplying power in the mill at 3-phase, 60-cycles, 440-volts. In the case of the Wisconsin Steel Company, the power unit is a steam turbine driven alternator with a capacity of 500 K. W. at 80 per cent. power factor, running at 3600 R. P. M. generating a 3-phase, 60-cycle, 2300-volt current, which is transformed down to 440 volts at the mill.

THE MASSEY COPPER MINE AREA*

By A. P. Coleman.

Copper ores have been found in many parts of Northern Ontario, partly in association with nickel, and partly as independent deposits; but at present the only copper mined in the Province comes from the nickel-copper deposits of Sudbury, in which nickel is the more important metal. Of mines opened for copper alone within recent years the Massey and Hermina mines in Salter Township are those on which most work has been done.

The Massey mine, or Massey Station mine, has been known for about thirteen years, and the history of its development may be found in several reports of the Bureau of Mines from 1901 to 1907.

As stated by the Inspector of Mines, Mr. C. De Kalb, in 1900, the copper-bearing deposits were first traced on the surface by test pits for a mile east and west a little south of the contact of granite with green schist, and a shaft was sunk 80 ft. on the main deposit. In later years the shaft was deepened to 550 ft. and on seven levels more or less stoping was carried on, furnishing some thousands of tons of ore. Part of this was shipped to Copper Cliff and to Victoria mines for use in connection with the smelting of the nickel ores, but apparently was not entirely suitable as a fluxing mixture. A plant was then erected in 1904 for treating the ore by the Elmore oil concentrating process, but this proved unsuccessful, and in 1907 the mine was closed down.

The Hermina mine was opened in 1903, and a shaft was sunk to a depth of 500 ft. In 1908 a smelter was constructed at Thessalon, partly to treat the Hermina ores and partly for custom work, but both mine and smelter have been closed down for some years. Both the Massey and the Hermina mines are connected by short railways with the Sault branch of the Canadian Pacific, the Massey mine branch ending at the station of the same name 3 miles southeast, and the Hermina branch 4½ miles long, ending a little east of Walford, the next station beyond Massey.

Massey Copper Mine.

A railway three miles long connects Massey on the Sault branch with the Massey mine, running first north and then bending toward the northwest, the workings of the mine being in the southwestern quarter of section No. 15. The railway runs over old lake deposits except for half a mile of mica schist, where the line bends northwest. Beyond this no solid rock shows itself until the mine itself is reached, where a low mound rises above the drift for 180 yards, consisting of quartzite toward the southeast and green schist to the northwest, both more or less brecciated and crossed by quartz veins. The bedding of the quartzite has a strike of 60 degrees east of north. The rock dump consists mainly of green schist with a good deal of reddish-gray quartzite and some massive vein quartz. A hundred yards to the east there is another patch of quartzite and crush conglomerate, but otherwise the surface in all directions is drift-covered. Say 200 or 300 yards northwest at the outlet of a pond which was dammed for a water supply, a glaciated surface of greenstone shows itself; and a quarter of a mile through the woods to the northeast there is green schist with a little slate and quartzite on the flanks of a hill whose top consists of red granite. The greenstone and granite are the nearest eruptive rocks to be seen, but the covering of drift may hide granite or greenstone in the immediate vicinity of the mine.

There is little ore on the dump, chalcopyrite being the only visible copper-bearing mineral, and it seems to be associated with the green schist rather than the quartzite.

The rockhouse is connected by tramway with the concentrating plant a short distance to the west, but at the time of my visit the caretaker was away, and the buildings were locked up.

Reports of the Mine Inspectors during the years when the mine was in operation give brief accounts of the results of mining. The ore was reported to run from 3½ to 6 per cent. of copper with traces of gold in 1901, when the mine was first opened; but in 1902, when the shaft had been sunk to 230 feet, 3,000 tons of ore are said to average 3½ per cent.; and in 1906, a year or two after the Elmore plant had been installed, it had fallen to 2.7 per cent. In 1904, the shaft is reported to have reached a depth of 550 feet with drifts from seven levels. It had an inclination of 87 degrees to the north, and the ore bodies are said to be overlapping lenses in slate.

Stripping is said to have shown the vein to extend for a mile; but only one of the other workings appears to have been of much importance. Half a mile west of the main shaft and 230 paces west of the line between sections 15 and 16, some stripping was done about 200 paces north of the road to Hermina mine. The rocks exposed on successive east and west ridges are alternating slate and quartzite with a nearly vertical dip. The stripping, which is extensive, shows from 4 to 6 ft. of ore, containing small quantities of chalcopyrite. Two hundred or 300 paces north, after an interruption of drift, the east and west range of granite hills rise much as was described near the main shaft.

A quarter of a mile west of this stripping, where the Hermina road touches a hill of rock to the north, a large amount of work was done, including the driving of a tunnel 120 ft. into the hill side. The hill consists mainly of quartzite, but with interbanded green schist, and quartzite extends north for 250 paces, beyond which there is drift. The rock dump at the tunnel shows mainly green schist with vein quartz enclosing some chalcopyrite.

*From Extracts 22nd Annual Report of the Bureau, 1913.

Hermina Copper Mine.

A large amount of work has been done at the Hermina mine where several shafts were sunk along a distance of more than a mile, running from southeast to northwest. The nearest workings to the Massey mine are on a hill about two miles to the west, where shaft No. 1 was sunk to a depth of 400 ft., according to Mr. John Thomann, who was in charge of the property as caretaker. The shaft is in green chloritic schist, but a belt of coarse quartzite runs for 200 paces north 70 degrees east, with a vertical dip a little to the southwest. The green schist is cut by veins of quartz with some chalcopyrite.

Shaft No. 2 is a little northeast of the road on quartz veins in coarse granite, and is said to be about 25 ft. deep. Two other small openings in granite with some greenstone occur a little southeast.

No. 3 shaft, the most important of the Hermina workings, is said by the caretaker to be 500 ft. deep, and a large amount of drifting has been done at different levels. The shaft is in a valley between hills of granite, including masses and bands of green schist. No quartzite was observed here. The granite is partly fine grained and partly coarse and pegmatitic. It has entirely the appearance of the Laurentian; and from the low hill tops one can see the pinkish granite and gneiss extending for a long distance to the north. The rock dump shows much green schist and quartz.

A fifth of a mile northwest of shaft No. 3, there is another small shaft on a large quartz vein in granite, with strips of green schist. Granite and greenstone extend for a mile southwest from No. 3 shaft along the railway to Walford, and the whole surroundings of the mine suggest Laurentian and Keenwatin rocks, except for a small patch of quartzite on the road between No. 3 and No. 2 shafts. The presence of this quartzite and of the strip near No. 1 shaft make it probable that both granite and greenstone are later than the Sudbury series.

From the descriptions just given it will be seen that the Massey and Hermina copper deposits follow roughly the contact of the granite with the sedimentary series but that the ore is mainly found in green schist. They are not contact deposits in the strict sense, however, but may occur a quarter of a mile north or south of the actual contact either in the sedimentary series or in the mass of eruptives. There has been a considerable amount of faulting and fracturing of the rocks along this line, as shown by crush breccias and the numerous quartz veins, though the ore itself is more apt to accompany the schist than the quartz.

SURF INLET GOLD MINE, PRINCESS ROYAL ISLAND, B.C.

The Vancouver, B. C. "Daily Province" lately published some particulars of the taking up, under option of purchase, by the Tonopah Belmont Development Co., of a gold mining property on Princess Royal island, British Columbia. The following gives the greater part of the article that was printed in the "Daily Province," and, as well an official account of the property, printed last year:

"For the past four years a Vancouver company has been carrying on development work on a gold prospect at Surf inlet, on the west coast of Princess Royal island. The Surf Inlet Mines, Limited, the owners of the property, have just closed a deal with the Tonopah Belmont Development Co., concerning which the following is the first authentic information available.

"The terms of the deal are that the Tonopah company proceeds immediately with further development work, and while no amount is stipulated to be spent on such work, it is estimated it will require an expenditure of about $150,000. If, at the end of a year, the results are satisfactory to the Tonopah company, it will pay to the Surf Inlet Mines, Limited, the sum of $150,000 in cash, take over the property, and will organize a company to operate it. The Surf Inlet Mines, Limited, will have a one-fifth interest in the new company, for which it will be allotted that proportion in shares in that company.

"The Tonopah company has appointed Mr. F. W. Holler to take charge of the work, and he has arrived in Vancouver for the purpose. He is placing orders for machinery, which will include air compressors and drills, and is sending up 25 men with supplies to erect the necessary buildings preliminary to engaging the mine staff. The work will be superintended by Mr. Holler himself for the present. Steam power will be used to operate the compressor.

"In the event of the mine being taken over by the Tonopah company a hydro-electric plant, and a mill capable of treating 500 tons a day, will be installed. The latter will include stamp batteries, tube mills and cyanide plant, and will constitute the largest gold mining plant in British Columbia.

"The property was examined during the winter by Mr. Humphries, consulting engineer for the Tonopah Belmont Development Co., and other members of their engineering staff; Mr. Heller, president of the company, has several times visited Vancouver in connection with the deal. The reports stated that the development work done by the Surf Inlet Mines, Limited, had made available about 150,000 tons of ore, of an average value of $6.60 a ton making total value of about $1,000,000. This comes very close to the estimate made by Mr. C. S. Verrill, M.E., of Vancouver, who was called in by the company about a year ago to make a report on the property. The development work was carried out under direction of Mr. F. M. Wells, superintendent of the Surf Inlet Mine, Limited.

"The Tonopah Belmont Development Co. has its head office at 501 Bullitt Building, Philadelphia, Pa.; it is one of the strongest mining companies operating in Nevada. It operates at Tonopah two mills, each of a capacity of 500 tons a day, and has ore developed of a net value of $15,000,000. The ore averages about $20 a ton, mostly in silver. The officers of the company are: President, Clyde A. Heller; vice-president, W. M. Potts; secretary-treasurer, K. Kitte; assistant secretary-treasurer, R. G. Wilson.

"The Surf Inlet Mines, Limited, is capitalized at $1,000,000, of which shares to about $800,000 have been allotted. The directors are: President, Captain Duff Stuart; vice-president, E. A. Cleveland; treasurer, A. H. Wallbridge; Jonathan Rogers, A. B. Clabon, Dr. Burnett and A. H. MacNeill, all of Vancouver. B. G. Hawkins, of the office of Messrs. Cleveland & Cameron, civil engineers, Vancouver, is secretary.

"The deal was arranged by T. M. Verrill, who has been at work on it for some time, his personal knowledge of the property and recommendation of it as an investment carrying much weight with the Nevada men with whom he was personally acquainted.

"The Surf Inlet mine is well situated for the development of cheap hydro-electric power, so that, in the

event of the proposed plant being installed, it will be operated with the utmost economy. There is abundance of good mine and building timber, and the climate is excellent, with the exception of a few weeks in winter. The property was first brought to the notice of Vancouver investors by Messrs. A. B. Clabon and F. M. Wells. It is probable that the capitalization of the company, which it is proposed to eventually organize to operate the mine and mill, will be about $2,000,000, in which case the Surf Inlet Mines, Limited, would be allotted 400,000 shares in addition to the $150,000 cash for distribution among its shareholders.

Report by the Provincial Assayer.

The following report on the property made to the Provincial Department of Mines by Mr. Herbert Carmichael, who was then Provincial Assayer and Assistant Provincial Mineralogist, was printed in the "Annual Report of the Minister of Mines, 1912":

"Princess Royal island lies on the coast of British Columbia, 180 miles north of Vancouver island. The island is of considerable size, being 60 miles long by 20 miles wide. It is very mountainous, but is intersected by lakes and numerous channels which afford good waterways. One of the fiords, called Surf inlet, runs 12 miles in from the Pacific ocean, forming a safe channel for sea-going vessels; at the head of the inlet Cougar lake empties, with a fall of 30 ft. into the sea. Cougar lake is one of a chain of lakes which, with short portages, gives easy access to a large portion of the island.

"The mining claims visited were the D. L. S. group and the Princess Royal group. These claims are on either side of a small stream flowing out of Paradise lake, and are reached by a short portage from Surf inlet to Cougar lake, a row of two miles along the lake, then a portage of a mile from Cougar lake to Bear lake, then a row of three miles up Bear lake to Paradise creek.

"The main tunnel of the D. L. S. group is situated on the northwest side of the creek about a mile and a quarter from Bear lake, and at an altitude of approximately 800 ft. above the lake or 850 ft. above sea-level. There is a good trail from the lake to the mine. The property is held by the Surf Inlet Gold Mines, Limited, Vancouver, B.C. The company owns nine claims located in the strike of a quartz vein occurring in granite country-rock and running diagonally into a mountain-ridge.

"Bluff Claim.—The principal work has been done on the Bluff claim. A small creek on the side-hill cuts through and exposes a quartz vein dipping southwest into the mountain at an angle of 32 deg. The vein has been followed by a tunnel in a northerly direction for a distance of 500 ft. At 20 ft. in, a short crosscut was run to the right, cutting through the foot-wall, which is well-defined with gangue-matter; the tunnel then swings slightly to the left, following the vein, but turning again to the right, so that the general direction is about N. 30 deg. W. At 135 ft. in, the tunnel cuts through a diabase dyke 7 ft. thick, which, however, does not displace the vein; 25 ft. farther in a crosscut was driven 12 ft. to the hanging wall, and a winze was sunk 18 ft. on the dip of the vein. Up to this point the vein-filling is quartz, with iron-pyrites scattered through it, and also a little arsenical pyrites. For the next 50 ft. the tunnel is entirely in vein matter, showing a fair amount of ore on both sides in a short crosscut of 5 ft. run to the right to the foot-wall. At 235 ft. in, the vein pinches, but again makes, and a good oreshoot was struck at 300 ft. From this point a long crosscut is being driven to the left at a deflection angle of 40 deg. to cut a vein lying to the west of the main vein, and on which some work has been done. This crosscut had been driven 243 ft. all in a granitoid rock, but at the face the ground was becoming brecciated and it seemed likely that the zone of disturbance, carrying the "west vein," was being entered.

"The main tunnel has been continued from where the crosscut branches off in the same northwesterly direction; for 50 ft. it follows the footwall, where a fair grade of ore was taken out; at this point a drift of 12 ft. was made to the left and is all in a fair grade of ore. The hanging wall is there followed for a further 50 ft., when a drift was run to the left for 20 ft.; this drift to the face is all in ore. The tunnel keeps the same general direction for another 50 ft., but the ground is more broken and the foot-wall is not well defined, what appears to be a horse coming in. At the time the property was visited the face of the main tunnel was in 500 ft.; at this point, while the ore was showing, it was more broken and the vein seemed to swing more to the right; later information would confirm this, as the tunnel has been driven farther to the right and is reported to be in solid ore. From the face a short drift has been run to the left, but, except for a few stringers, was in country-rock.

"A trail goes along the hillside to the north, rising above the tunnel; this leads to a gulch where a strong outcrop of a quartz vein is seen dipping into the hill and having the same general strike as the vein in the tunnel, so that there is every reason to suppose it is the same vein. At 280 ft. north of the tunnel-mouth and 171 ft. above it, an inclined shaft had been sunk on the outcrop of vein, having a dip of 32 deg. to the northwest; the shaft was reported to be down 50 ft., with ore at the bottom, and a raise run to the hanging-wall, which it cut through, giving the vein a width of 18 ft.; but this could not be examined as there was several feet of water in it. This vein is well defined and has the same dip and general character as seen in main vein in the tunnel. It is the intention of the management to run an upraise from the main tunnel to connect with this shaft.

"What is known as the "west vein" outcrops in the creek 300 ft. to the northwest of the portal of the main tunnel and 143 ft. above it. A drift from the gulch was run in on the vein for 30 ft., showing good ore, from which high value was obtained. As working was difficult from the adit on the gulch, a short drift was run through a shoulder of rock to the hillside, and this is the working entrance. At 25 ft. in from the gulch a drift was run to the left for 300 ft.; this is for the most part in a quartz-breccia with good ore showing in the face. From the intersection of the right drift the tunnel has been driven in a northerly direction for 40 ft., mostly in country-rock with a little quartz. The tunnel then swings to the left, running nearly northeast for 30 ft.; at 7 ft. from the turn a stringer of iron-pyrites 10 to 18 in. wide was cut; this yielded fairly high assays in gold, otherwise the tunnel is in country-rock. At 30 ft. from the turn to the left, the tunnel cut into a well-defined quartz vein dipping at 40 deg. to the northwest. A drift at right angles follows the foot-wall of the vein northeasterly for 30 ft., for which distance the vein is well defined and the face in ore, the samples taken giving good value. The mineralization consists of iron-pyrites, with a little arsenical pyrites, in quartz gangue. This is the vein that the long crosscut-tunnel from the main vein is expected to intersect.

"Summary.—The property contains two or more well-defined quartz veins which have been proved by underground work for considerable distances. It is fairly easy of access, and the treatment of the ore presents no serious difficulty. The value of the property depends then on the average assay of the ore, and this has not yet been determined with any degree of accuracy."

MINING INVESTMENTS

Report of Committee, American Mining Congress, Philadelphia, Octo. 20-24.

We find a unanimity of opinion among mine owners, prospectors and investors for such laws and regulations as will tend to drive from the field that class of promotions that are not founded upon merit, fair dealing, or justice.

We fully realize that no other occupation offers more opportunities for success and large profits. Ever since the creation of man has the search for metal been carried on; ancient history from the time of Tubalcain, the first worker of metals, records human activities in the search for and the manufacture of minerals and metals that have been so useful and necessary to mankind.

There are two great fundamental industries on which civilization is based and our very existence depends; mining and agriculture. These two industries must necessarily be carried on hand in hand, each working with and through the other. One cannot exist or be of value without the other. These two make up all the essentials, comforts, conveniences and necessities of life.

The science of agriculture can, and, indeed has, become a purely mathematical problem; its hazards are so limited as to admit of the smallest possible profits, with a reasonable degree of certainty; all that pertains to agriculture can be seen and comprehended. It is far different with the mining industry. In dealing with this branch of our existence no well-defined law of nature can be followed; no satisfactory rule of man can be depended upon. It is true that the study of minerology, geology and chemistry has, and will enable the human eye, to a degree, to see further than the surface of the earth; but at best, all deductions made are more or less speculative. To formulate any set rule for the discovery of ore, or estimating the value of minerals not seen or uncovered, is impossible; therefore, as the uncertainties increase so should the profits.

The mining industry requires the genius of man, the brains of the world; perseverance, unlimited hope, and a great amount of capital. As a rule, mineral is not found in places of easy access.

The Prospector.—The millionaire, or man of moderate means, is content to leave the unexplored fields to that intrepid, dauntless, fearless,, and courageous body of men known as prospectors, buoyed by hope, with unbounded enthusiasm and encouraged in the belief that they will discover mineral. This army of argonauts is found wherever traces of mineral exist, toiling without certainty of reward, suffering hardships and enduring privations; but few realizing their dreams. Throughout all mining regions rest the dust in unmarked graves of the prospectors who have passed from life without reward. As we enjoy the implements of modern civilization, little do we realize the blasted hopes, the disappointed lives, the unpaid labour of the prospectors that have been imprinted upon the tablets of progress and time before the results of their labour could be put to commercial use. Not only every miner and mine owner, but civilization itself should encourage and assist the prospectors; to that end laws should be framed for their protection, as well as the protection of the investor. Our endeavour should be to put the investor in touch with the prospector, and the prospector in reach of capital. One is as necessary in the development of the industry as the other; one is the pioneer, the other the builder. Thousands of prospectors, who will never be able to accomplish anything in their lifetimes, could develop properties of great worth and value if they only had the necessary funds.

Millions of acres contain hidden treasure that cannot be reached by the prospector's pick, yet by surface indications he knows full well of the mineral existence. Large cities will yet be built; billions of wealth will be poured into the world's treasury from ore deposits yet undiscovered.

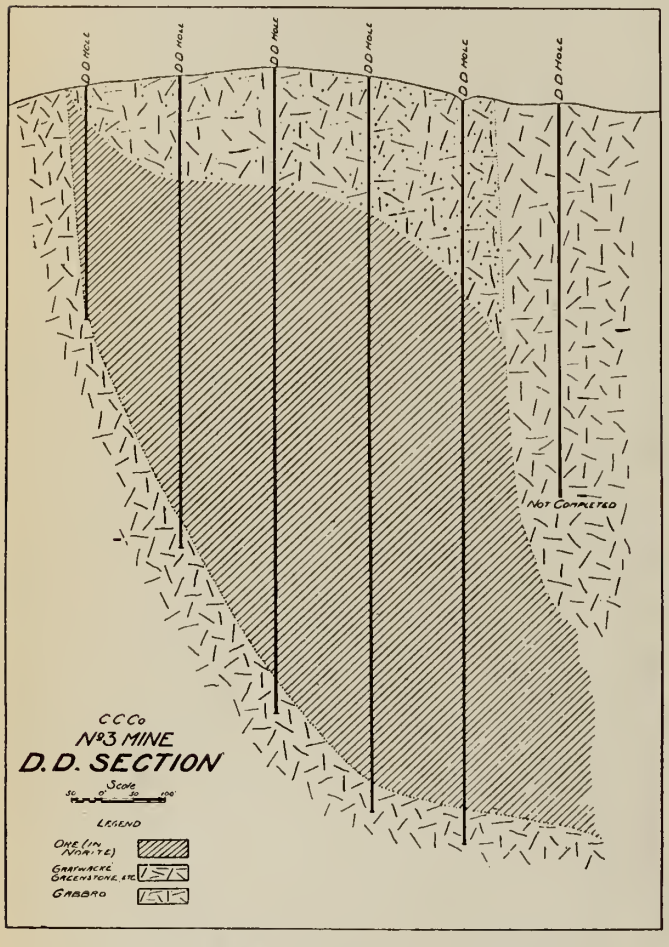
Laws Should Assist.—We should not, by laws, harrass; but rather assist and encourage in the development of the mineral resources; lend encouragement to the prospector, protect and assist him in the development of the mining industry. There are three necessary factors; the prospector, the promoter and the investor. The legitimate, honest promoter who, after careful investigation finds a prospect worthy of development and enlists the necessary capital, is entitled to his reward. He is entitled to some of the credit that is due those whose endeavours go to make this industry great. The investor is entitled to more than ordinary returns upon his investment; he has no absolute assurance; he may lose all or he may receive enormous returns. He is entitled to every safeguard that can be reasonably thrown around him.

Mines and Prospects.—There are many who invest in mining propositions who do not know the difference between a mining prospect and a developed mine. A developed mine is a commercial proposition, operating upon a commercial basis and returning certain annual premiums. In mines of this class the element of speculation is past, also the element of chance for large returns. The investor in the developed or developing mine is in the class that may hope for large returns; but there must always be associated an element of chance. If, after proper investment of the funds and careful and competent management, the project fails to develop, there should be no complaint on the part of the investors, for they would have willingly and gladly accepted any returns no matter how large.

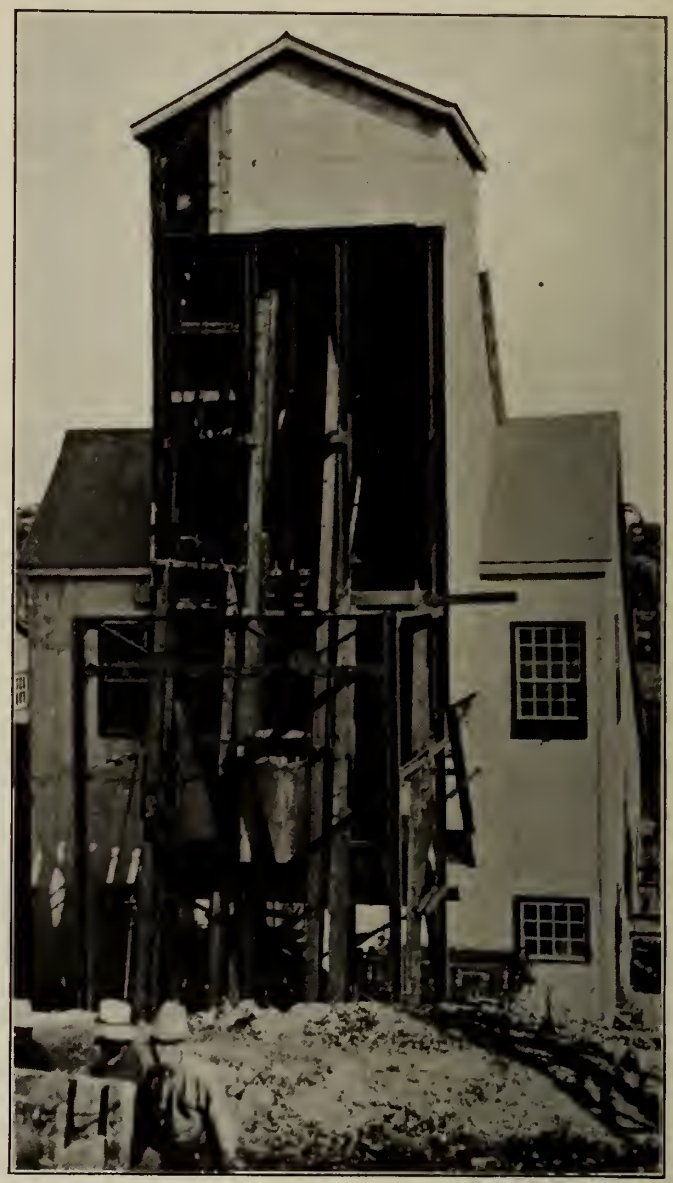
Losses in Mining Investments.—If the money lost from mercantile business failures, as reported by the commercial agencies, could be compared with the money lost through legitimate mine development, and this comparison be compared with the profits on each line pro rated with the investment, I am of the opinion that the balance would be on the mining side. I am of the opinion that the percentage of failures would be smaller in the mineral column. The great question before us is how to prevent unscrupulous and conscienceless promoters from entering the field and fleecing the public, thereby doing the mining industry and legitimate mine promoter and prospector irreparable injury. Any field of endeavour that promises large returns will always attract the criminal and dangerous class of promoters that prey upon the unsophisticated and gullible public.

Eliminate the 'Wildcat.'—It is my desire and it is the desire of every delegate in this Congress to eliminate the wildcatter and the promoter of worthless mining propositions. The growth and development of the industry can be retarded, however, by enacting such laws as will make it prohibitive for the small mine owner

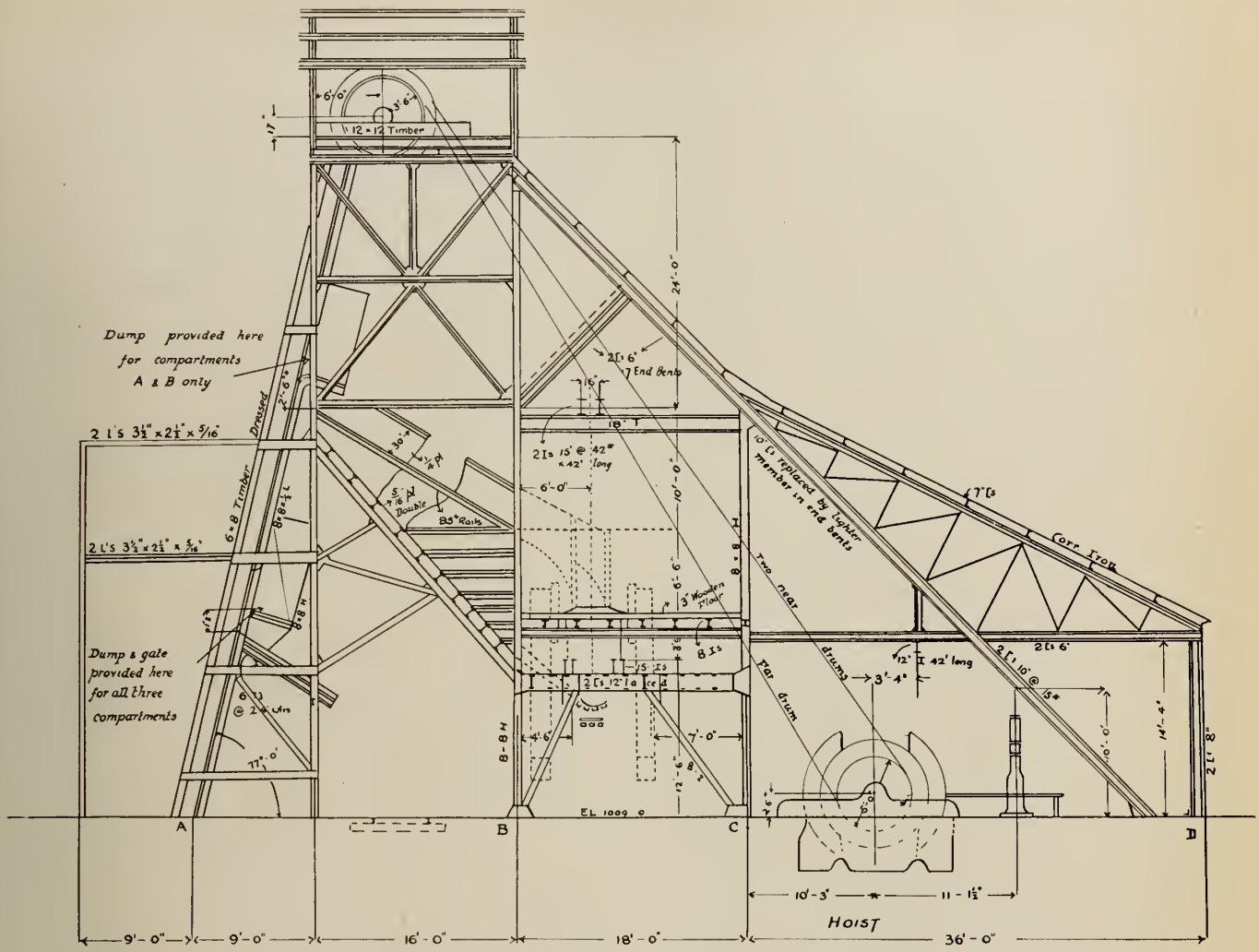
ROCK-HOUSE AT NO. 3 MINE CANADIAN COPPER COMPANY

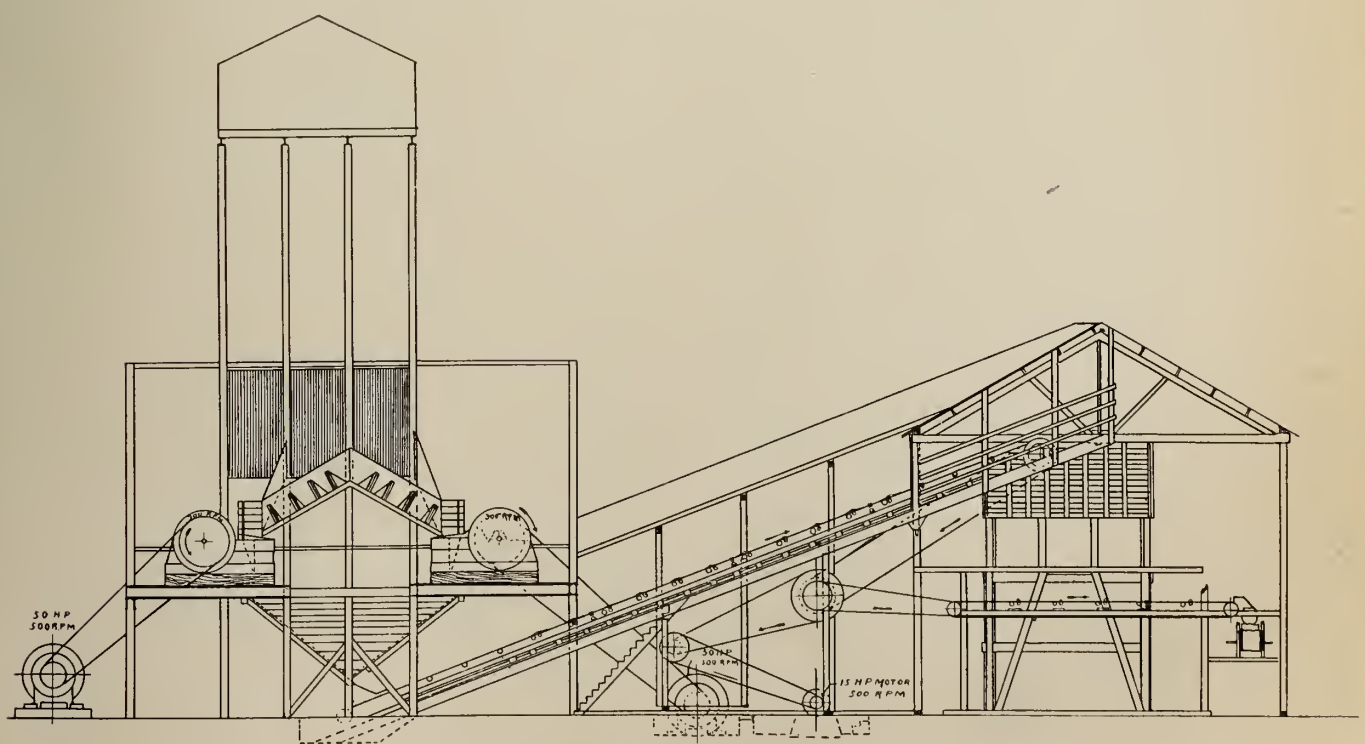


Geological Section of No. 3 Ore Body.
After A. P. Coleman.



No. 1 Shaft, No. 3 Mine, Canadian Copper Company.





Rock-house at No. 1 Shaft, No. 3 Mine, Canadian Copper Company.

and prospector, through his honest legitimate promoter, to reach the investing public.

Proposed Law.—After a careful study of the laws now upon the statute books in a number of States; after watching their operations, I am of the opinion that the law that will best serve the interests of the prospector, mine owner and legitimate promoter, and at the same time fully protect the investor, will place no arbitrary powers in boards of State officials. I am of the opinion that a law should be enacted by every State in the Union, governing the sale of mining promotion stocks that will give to the mining investor accurate information of the plan of organization, amount of capital stock or bonds, amount to be paid for the property, either in stock or cash, condition of titles, whether held by lease and bond, owned outright, patented or unpatented, amount of development, names and references of officers and directors, salaries paid to officers and managers, and all other information concerning the company, leaving it to the investor to decide for himself, as he must do in any other investment or business venture, as to the honesty or capability of the management, the possibilities and probabilities of success. This procedure will force mine owners and promoters to procure engineer's reports and any other information bearing upon their property.

Laws Dealing with Fraud.—Most all States have laws dealing with misrepresentation and fraud. Anyone who files with the State Department, for the purpose of securing a license to sell stock, information concerning the property that is erroneous, may be prosecuted under the laws covering fraud and deception. The laws governing the sale of stock or bonds may be divided into two heads; publicity and supervision. Publicity is essential and it may be profitably used to the benefit of all; it can be made a fountain head in each State whereby the investor can gain all the information that he may desire, concerning any security offered, but I seriously doubt if it would be advisable to place the power with the State officer or board to pass upon the question as to whether or not the security offered is a good investment. Again, a man, board, or commission in Illinois, Pennsylvania, New York or New Jersey, could not intelligently say that a mining proposition located in Montana, Colorado or California is not meritorious. I believe that State Departments should require and have on file at all times, information that tends to enlighten the investor and give the facts, such information to be presented in affidavits by the officers of the corporation desiring to sell stock.

Sale of Stock.—Thirty-six States in the Union have under consideration laws governing the sale of stocks, bonds and securities. Kansas adopted the first "blue sky" law, known as the Dolley law. The law is administered under the State bank examiner or commission. Other States left the question to the Secretary of State, secretaries, commissions and others. In Montana the administration of the law is left to the State auditor or commissioner of insurance. Arizona has a law adopted in 1912, following very closely the Kansas law. Arkansas has provided a "blue sky" law, which went into effect in March, 1913. The Colorado Legislature passed a "blue sky" law the day before adjournment, but it was vetoed by the Governor. Idaho, Montana, North Dakota, Vermont and West Virginia have enacted laws similar to the Kansas law. Iowa has a law that is more comprehensive than almost any of the laws that have been adopted. Maine has passed a law to go into effect January 1st, 1914. Michigan, Missouri and Ohio have adopted laws that are now in effect. Oregon has passed a law which becomes effective next March. South Dakota has adopted a law which contains restriction of the Kansas law of 1911. Laws have been under consideration by the Legislature of North Dakota, Illinois, Massachusetts, New Jersey, Pennsylvania, Rhode Island and Wisconsin; the Legislature of Delaware, New Hampshire, New Mexico, North Carolina, Utah and Wyoming adjourned without enacting laws upon the subject; Indiana passed a law, but it was vetoed by the Governor, who appointed a commission to study the subject. The Minnesota Legislature adjourned without getting to any agreement upon the "blue sky" law. The New Jersey Legislature adjourned without enacting any legislation, notwithstanding the recommendations of President Wilson when he was Governor of the State.

CANADIAN COAL AND COKE.

Mr. H. A. Lovett, K.C., president of the Canadian Coal & Coke Co., in a circular issued this afternoon says: "In 1913 your company acquired the properties of the Lethbridge Collieries, Ltd., Western Coal & Coke Co., Pacific Coal Fields, Ltd., and St. Albert Collieries, Ltd.

"The acquisition of these properties involves raising the funds necessary to pay debts, provide for the completion of the development and equipment of the properties and working capital. The company for the purpose of its permanent financing has authorized the issue of $3,000,000 par value of bonds, and for the purposes of temporary financing has authorized $1,500,000 of short-term securities, for which the bonds are pledged as collateral.

"It has been deemed in the interests of the undertaking that some arrangement should be made to secure a substantial agreement in the voting of the shares and a uniformity of management over a period of years, and for this purpose a committee consisting of representatives of the bankers, Hon. Nathaniel Curry and Gordon W. McDowell, K.C., has been formed to vote the stock and a stock deposit agreement has been lodged with the Royal Trust Company."—The Globe.

ALUMINUM.

Bauxite, the commercial ore or aluminum, has not yet been found in Canada, but the metal aluminum is produced from ores imported from France, Germany, and the United States, in extensive reduction works situated at Shawenegan Falls, Quebec. The plant is operated by the Northern Aluminum Company, a subsidiary of the Aluminum Company of America. A portion of the bauxite used at these works is mined from the Company's mines in the States of Arkansas and Georgia, and refined at East St. Louis, U.S.A.

The Shawenegan plant covers an area of about 10 acres and includes reduction buildings and a wire mill. The Company employs the Hall, or Heroult electric reduction process for the manufacture of aluminum. The furnaces, or cells as they are locally termed, are rectangular in shape, the bottom of the cells forming one electrode, while a number of carbons suspended over the cells form the other electrode. These cells work continuously, the reduced metallic aluminum collecting at the bottom, whence it is tapped off from time to time, and moulded into bars. There are 340 cells in operation, each producing on an average 150 pounds of aluminum, of 99.4 per cent. fine per day.

The exports of aluminum in ingots, bars, etc., from Canada during 1912 were 9,143 tons, valued at $2,002,363, besides manufactures of aluminum valued at $10,898.

THE FORMATION OF METALLIFEROUS DEPOSITS*

By M. De Launay.

Modern works, many of which have been written by Norwegians and Americans, accentuate the relation between metallic ores and eruptive rocks. This interdependence has led to the classification of metalliferous deposits into several groups. If the fundamental hypothesis of relation between ores and eruptives from their origin be accepted, we are induced to establish a corresponding connection between the nature of the deposits and the depth at which they are formed.

Let us consider an eruptive rock that is in course of crystallization under cover of sedimentary strata. If the magma contains minerals they will manifest a tendency to ascend in the guise of metallic exhalations. Analyses prove that eruptive rocks possess traces of many metals, and that in the case of iron they include as much as 7 or 8 per cent. These metals first form an unimportant aggregation of small disseminated grains that have received the name of "inclusion deposits." Some metals thus distributed have been found exploitable, as, for example, platinum, iron, chrome and nickel, and even the diamond.

After the inclusions, the elements group themselves more densely in the midst of the eruptive rock and still at a considerable depth, and we have "deposits of metallic segregation." These have a practical importance, since mineralized masses over 150 feet thick occur. They are deposits which have been formed at great depths, and can only be encountered in very primitive rocks, such as exist in Scandinavia and Canada, where they are well developed.

Succeeding these magmatic segregations, confined to the eruptives, there follows a different process, that of the deposition of metallic exhalations on the exterior of eruptive rocks. This is commenced by the appearance of sulphide ores massed at the contact of the eruptive with other rocks. They are designated as "peripheral sulphide segregations." In the mass of eruptives are found only small quantities of sulphides but plenty of oxides, whilst at the junction rocks sulphides concentrate and crystallize abundantly. These types of segregation, up to now very rare, constitute important deposits of copper, nickel, etc., which are, for example, successfully exploited in Canada.

Still at a considerable depth, deposits have been produced that appear in the form of lenticular bodies with transverse veins. This type, termed "diffused impregnations," is of great consequence. There are certain regions with veins enclosing sometimes copper and often gold; they are troublesome to work, since they are very irregular and prone to peter out suddenly. Notwithstanding, they are considerably exploited on account of concentrations, due to earth movements, and give rise to alluvial deposits through disintegration.

We now reach the true fissure type of mineral deposition, at first those which are directly connected with eruptive crystallized at great depth, then with more superficial deposits associated with microgranites, and, lastly, microlithic. With granites exhibiting white mica, tin and its group is developed, sometimes accompanied by copper; then follows copper associated with lead and zinc, and, still higher, mercury—all in the true fissure group.

At surface little ore is formed directly from the rocks; these are only the results of mineral concentration derived from the denudation of previously existing deposits. The predominating proportion of minerals appear to have been crystallized at immense depths under varying conditions of heat, pressure, etc.

We have just remarked that the occurrence of mineral deposits may be classed as inclusions, segregations, peripheral segregations, impregnations, and veins of fracture. A question arises, have these different deposits remained from the time they were deposited in the same state as we now find them, and are they produced in any region where similar conditions prevail? It is to be observed that deposits are not the same in all regions; and if a miner, for example, were transported from the basin of the Mediterranean to Norway, he would fail to recognize the types to which he had been accustomed, and if he endeavored to apply brusquely the empirical results of his previous experience to these new types, he would have every chance of going wrong. Each region possesses, then, its own peculiar aspect, generally very different from others, and this is especially the case in passing from the north to the south of Europe. On the other hand, some parts remote from each other display certain analogies. Thus the same types obtain in the Central plateau, Bohemia, or Saxony, and the geologists of Freiberg have noticed in Asia, especially in the Altai, deposits similar to those in their own district.

We can, therefore, arrange deposits in metallogenic provinces which are adjusted to the age of the corresponding tectonic zones, and that have successively permanently crystallized under the influence of regional metamorphism, which have since suffered only vertical movements and have usually remained without any further mineralizing action. In Europe there can be distinguished from north to south a Huronian zone, a Caledonian zone, a Hercynian zone, and a zone influenced by the folding of the Alps; their equivalents exist also in other continents. In the Huronian and Caledonian of Scandinavia, the types of inclusions, segregations and impregnations are exceeding well represented, and their equivalents are present in Canada, Brazil, India, Siberia and Central Africa. In the Hercynian of Central Europe has been developed the petrographic type of porphyries harmonizing with a semi-profoundity characterized by the occurrence of veins containing blende, galena and pyrites. More to the south are the folded Tertiary formations, accentuated by numerous volcanic intrusions, in which are found auro-argentiferous minerals and also mercury, a metal that is able to deposit itself in proximity to the surface. If we examine a particular region, outside the deeply-seated igneous masses, we shall find metalliferous aureoles showing an analogous succession—first tin, followed by copper, zinc and lead, and finally mercury. It should be observed that for each of the types we are led to class the metals by groups which overlap each other, the natural sequence, however, persisting. It must not be imagined that each metal occurs as an isolated deposit, but as forming part of a whole, so that it would be a blunder to have a concession for a single mineral.

We now pass to another question. As deposits are not independent of their position in space, neither are they so in their place in time. Since formation metalliferous deposits have undergone modifications and

*Extracts from a lecture delivered to the Societe de l'Industrie Minerale, published in the Mining Journal, London.

but as forming part of a whole, so that it would be a blunder to have a concession for a single mineral.

We now pass to another question. As deposits are not independent of their position in space, neither are they so in their place in time. Since formation metalliferous deposits have undergone modifications and have not been able to remain in the state in which they were crystallized out in remote ages. These changes have been determined by their approximation towards the surface, and the effects of superficial action must be conceded to extend to a depth of several hundred yards. Fissure veins have a limit both in depth and in height, and if we find them cropping out at surface, it is because denudation has removed more or less of the crust and exposed them to-day. This exposure has induced reactions in the upper parts of lodes which have gradually transposed minerals to continually deeper portions of the veins.

There is everywhere a point beneath the surface where water is reached and below this horizon aqueous actions and movements are decelerated. The nature of the region above this hydrostatic level is entirely different, and throughout this space the surface waters, charged with oxygen, carbonic acid, etc., percolate, reacting on rocks and minerals, and issuing from the surface as springs. It is interesting to note the alterations which are produced in this upper portion, and to a certain distance also under the hydrostatic level, by the incessant circulation of superficial waters. The present was preceded by a higher surface, the vein extending up the interspace, and in which certain ores were placed in solution—for example, copper; this dissolved copper was partly washed away by the rains, but a portion was also precipitated in the vein at some distance beneath. This action continued to the gradual enrichment of the lower zone by cementation. At a varying depth under this zone the unaltered vein becomes, more or less, suddenly poorer. Gold lodes are affected in a similar manner, the lode above the unaltered zone assuming an abnormal productiveness, and the same for silver lodes. These phenomena entail important consequences, of which numerous instances could be cited; a prominent case will be sufficient. When ores are enclosed in calcareous strata these reactions attain a maximum of intensity; thus one is able to refer the development of calamine deposits to the phenomenon of cementation. They are the result of the transformation of blendes, and are not formed in depth. Similar action changes spathic iron to iron oxide, which is shown in iron cappings and in the extensive masses of hematite worked at Bilbao and other places. In the mines of Leadville galena has been converted into cerrusite, but this action is less frequent than for zinc and iron, since the compounds of lead are less soluble.

To sum up, in the presence of metalliferous deposits it is essential to attribute considerable significance to this vadose action; if the country is accidented and if the water level is at a great depth, as in the Andes and Mexico, such alterations may reach a depth of 900 to 1,200 feet. The study of these transformations is interesting from a theoretical point of view, as it affords an explanation of facts inadequately interpreted by the theory of lateral secretion. It is possible thus to construe the presence in these enrichments, formed at an epoch almost contemporaneous, of bones of modern animals which have been enclosed in them. The alterations of minerals much more ancient is confirmed by similar crystallizations of sulphides and oxides often produced in old and abandoned mines. When we are prospecting a new country, we are enabled to grasp some knowledge of its general tectonic character, and to form an opinion on the nature of the enclosed ores, and to determine in what direction operations should be undertaken.

ROSSLAND ORE DEPOSITS*

By O. E. LeRoy.

Rossland is situated about six miles west of Columbia River and five miles north of the International Boundary. The main avenue of the city is 3,410 feet above sea level. The city lies on the slopes of Red and Monte Christo mountains towards the head of Trail Creek. The immediate surrounding country is characterized by mountains with rounded peaks and gentle, flowing slopes. The city commands a view of Trail Creek Gulch, the Columbia Valley 2,000 feet below, the Selkirk Mountains to the east and the ranges in Northern Idaho and Washington to the south.

The first discovery near Rossland was made on the Dewdney trail in 1887, when the Lily May claim was staked. In 1890 the LeRoi, Centre Star, War Eagle, and other mines were staked on Red Mountain, and a small lot of ore was packed out in 1891 and shipped to an American smelter.

The total production from 1894 to 1912, inclusive, according to the Provincial Bureau of Mines, amounts to 4,105,358 tons, containing 1,995,589 ounces of gold, 3,381,421 ounces of silver and 86,608,170 pounds of copper. The gross value is placed at $55,100,259.

The principal mines at present are the LeRoi, War-Eagle, Centre Star group, owned and operated by the Consolidated Mining and Smelting Company, and the LeRoi No. 2 Company. The greatest depth reached is 2,200 feet below the surface outcrops, and all ore mined is shipped to Trail for treatment.

Ore Deposits.—There are two mineralized belts in the Rossland camp, known as the North and South belts, respectively. The North belt is by far the most important. All the rocks, except perhaps the later dikes, are more or less mineralized, but the larger ore bodies are confined mainly to the Carboniferous augite porphyrites and the monozonite, and lie along the northwest border of the large area of monzonite, and near or on the contact of the porphyrites and Mount Roberts formation with the monzonite, granodiorite or granite porphyry. The South belt is underlain mainly by the porphyrites and sediments of Carboniferous age.

In the North belt, the ore deposits occur (a) in fissure veins with or without replacement of the country rock; (b) as lodes in zones of fissuring or shearing, the ore minerals forming a network of veinlets impregnating or replacing in whole or in part the intervening masses of country rock; (c) in irregular impregnations in the country rock. The most important ore bodies found so far have occurred as indicated under (a) and (b). On the basis of mineral contents, the ores may be classified as follows:—

1. Massive pyrrhotite and chalcopyrite ores with some pyrite, occasionally a little arsenopyrite and more rarely magnetite and molybdenite. Galena and blende have been found in a couple of instances. Free gold occurs, but is rarely visible though the proportion runs from 10 to 50 per cent. of the total gold content.

2. Massive coarse grained pyrrhotite with but little copper and gold.

3. Pyrite and marcasite with arsenopyrite in veins with possibly some galena and blende. This type is

*Extracts from Guide Book, No. 9, prepared by the Geological Survey of Canada, for Twelfth Session International Geological Congress, August, 1913.

more characteristic of the South belt, and silver may form an important part of the values.

4. Arsenopyrite, pyrrhotite, pyrite, molybdenite, a little chalcopyrite, bismuthinite, and free gold, as impregnations particularly in and around pegmatitic and aplitic dikes of alkali syenite.

5. Gold bearing quartz veins.

Gangue.—The gangue is chiefly more or less altered country rock with some quartz and locally a little calcite. The country rock may be altered to quartz associated with secondary biotite in bands. Hornblende and chlorite are extensively developed in places. Muscovite, tourmaline, garnet, wollastonite and epidote also occur, and zeolites, chiefly anthophyllite and chabazite, are frequently found.

Ore.—The typical ore consists of more or less altered rock matter with reticulating veins and irregular masses of pyrrhotite, and varying amounts of chalcopyrite with perhaps a little quartz, the sulphides forming from 50 to 65 per cent. of the mass. There are all transitions from the solid sulphides forming massive shoots of ore on the one hand to rock matter or gangue on the other, with little apparent mineralization. In cases, however, lightly mineralized gangue may carry high gold values.

The values are largely gold with some copper and a little silver. The gold values do not appear to be dependent on the presence of any one mineral, though in many cases ore rich in chalcopyrite is rich in gold. The pyrrhotite, though gold bearing in some instances, is as a rule very low grade. An average analysis of the ore from the large producers gives—gold 0.5 oz. per ton, silver 0.3 oz. per ton, copper 0.9 per cent., iron 22 per cent., silica 37 per cent, sulphur 10.8 per cent., lime 4.2 per cent., aluminum 14.9 per cent. The ore from near the surface yielded the higher values, but the proportion of free gold does not appear to decrease with depth and high-grade ore bodies are still encountered at the lowest developed levels.

Oxidation extends downwards only a few feet from the surface. Secondary enrichment is a minor feature, but is found at several points well below the zone of weathering.

Lodes.—The chief lodes or veins have a general easterly trend and northerly dip with an associated fault system trending north and south. The LeRoi-Centre Star main and south lodes and the Josie lode strike about N. 60° E. The LeRoi north vein, the War Eagle vein, and the Centre Star north veins strike N. 70° W., and appear to be off-shoots of the main lodes. The dips are to the north ranging from 60° to 70° with local flattenings.

The main LeRoi-Centre Star lode is at least 4,000 feet long, with a thickness varying from a mere crack to over 130 feet. The maximum thickness cannot in many instances be determined owing to the lack of sharply defined walls. Between ore shoots it is sometimes very difficult to trace the lode, particularly where the continuity is broken by faults and dikes.

Ore Shoots.—The ore shoots vary greatly in size and shape, lenticular bodies being the more common. Some are very irregular at one termination, especially when forming against a dike or fault. In such cases the shoot either develops an enormously increased thickness or an L-shaped body is formed by the ore turning sharply and following the plane of the fault or dike. The pitch varies from vertical to a pronounced easterly or westerly direction dependent upon purely local conditions. In size the shoots vary from a foot to 130 feet in thickness and from 50 to 500 feet in length. One of the largest shoots was stoped for 590 feet vertically and averaged 50 feet in length and 56 feet in thickness.

The higher grades of ore are often confined to certain bands in the shoot parallel to the trend of the lode. They either occur in the body of the shoot or on the hanging or foot wall sides. These bands may also change their relative positions suddenly and follow other though parallel planes in the shoots.

The pay ore is sometimes bounded by a fissure or fault plane. More often, however, there is no sharply defined wall, but a transition, usually rapid, from commercial ore to "waste" or nearly barren rock.

The positions of shoots are usually along contacts between the lode and fault planes with impervious walls or dikes. In the case of the dikes, the shoots usually form on the under side. When the mashing or shearing of the rock is such that the metal bearing solutions are restricted within zones of reasonable width, other things being equal, the conditions are favourable for the formation of productive ore shoots. The importance of the shoot is oftimes accentuated by the development of a system of cross fractures emanating from the wall rock.

In the LeRoi, shoots have been found along the contact of the augite porphyrite series and the coarse monzonite and diorite porphyry.

Origin.—Ore deposition began subsequent to the extensive intrusions of alkali syenite and continued up to the period of injection of the last system of dikes. It is thought probable that the deposits are closely related to the alkali syenite.

The deposits were formed through the agency of ascending aqueous mineral-bearing solutions of high temperature which gradually replaced the primary minerals of the country rocks, particularly the feldspar.

Certain minerals in small quantities, such as garnet, wollastonite, epidote, amphibole, pyroxene and magnetite suggest an approach to the conditions under which contact metamorphic deposits are formed. Other minerals are characteristic of hydrothermal action such as tourmaline, muscovite, chlorite and zeolites. The paragenesis of the minerals has not been worked out, but pyrrhotite is cut by veinlets of chalcopyrite though in many cases the two minerals appear to have been contemporaneous.

The values so far have not greatly decreased with depth, though this is not apparent in the production since more lower grade ore can now be mined than formerly, because of reduced smelting charges. The evidence though not conclusive, is strongly in favour of almost the entire deposition being due to ascending solutions, though possibly at two or more periods. In the first period, the diking and faulting phenomenon accompanying the formation of the lodes formed barriers which afforded favourable conditions for the precipitation of copper and gold. A favourable area for deposition appears to be the underside of dikes. In the second period, ascending solutions of different composition may have deposited new minerals in the ores or concentrated at successively higher levels, the values of the ore minerals formerly deposited.

If a zone of true secondary enrichment ever existed, it was swept away during the heavy erosion accomplished by the Cordilleran ice sheets.

The success that has attended the vigorous development policy of the operating companies, gives no indication that the productivity of the lodes is near the end, nor even on the wane, but on the other hand, gives every encouragement to the view that ore bodies will be found at much greater depths than the levels now being exploited.

MINING COSTS*

By J. B. L. Hornblower.
Comptroller Pittsburg Coal Company.

It is with some misgivings that I undertake, at the request of the officers of this convention, to lead in the presentation of the subject "Mining Costs." This is not because the subject is one unworthy of your time and attention, nor that my study of it has been meagre or superficial, although doubtless a more experienced and capable leader might easily have been chosen for the service, but because the matter of the proper construction of mining cost accounts and the use of the same by those vitally interested does not usually receive the attention and consideration which it deserves. Perhaps this fact influenced your officers in introducing a paper on the subject and inviting your attention to its consideration and discussion. However this may be, I believe that the subject is one of great importance and I therefore have consented to discuss it, more in the hope of emphasizing some things which we all know more or less, but sometimes forget, than of presenting any new or startling views upon it.

First. Who are interested in mining costs? The foremen, superintendents, general managers, executive officers, boards of directors and stockholders—the viewpoints of these respective classes are different, but all are, or should be, greatly concerned to secure the truth, the whole truth and nothing but the truth. Carelessness and indifference as to statements made are, in the last analysis, of the same texture as wilfulness and misrepresentation and frequently lead to the same disastrous results.

Second. How may these statements be made to most accurately and clearly set forth the information concerning actual conditions, which is so necessary to those whose capital and reputations are at stake?

The limit of time you will fix for the consideration of this subject, among the many other important matters which are to engage your attention, makes it necessary for me to avoid details as much as possible—to outline rather than elaborate.

Interest.—Interest on capital invested in lands, mining rights, plants and equipments, and discount on bonds issued against such investments, should not be charged to mining cost. Interest on bonds sold for the purpose of constructing specific plants is commonly charged to such construction cost up to the time when the plants are ready for operation, but this practice easily runs into an abuse and a misrepresentation to bondholders, stockholders and the public. An operating company will not err but rather commend itself to all concerned by holding to an absolute rule not to capitalize interest under any circumstances. Many companies in the past, which sold bonds for less than face value, charged such discount to property or construction account. This practice is now less common and will doubtless gradually disappear in companies which wish to be credited with conservative management and frankness in reports to stockholders and the public.

Taxes.—Taxes in an operating company should be charged to operations, never to property. The amount of tax chargeable to the operation of a given mine ought to be, as nearly as may be, the tax upon the land which will ultimately be operated through that mine. The tax for a given year should be apportioned in equal amounts over the divisions of the year for which cost statements are made.

Royalty or Property Depletion.—The value of coal or mineral rights, at cost, should be extinguished at a charge to operations in a fixed amount per ton or per acre as the property is exhausted. Some companies have revalued lands on their books and so created a surplus. This, in probably almost every case, was not a wise thing to do. Assuming that the transaction was thoroughly honest in intent, properly shown on the books of the company as a surplus not derived from operations, and properly followed up by increased charges to future operations for exhaustion, it will appear in the last analysis to be simply reaching into the future. I would say, therefore, that while such revaluation in some cases may seem to be justified, in most cases it is a thing which ought not to be done. If the lands are really worth more from year to year than their first cost, the fact will be reflected in increased selling value of the product. The difference of value, believed or hoped to exist, ought not to be put into surplus account in advance of actual sales of product, thereby increasing in a fictitious way in corresponding amount the mining cost of the future—in other words, it may be said to be always wiser and more conservative to book earnings as they are actually realized, not as anticipated or hoped for.

Depreciation of Plant and Equipment.—There is, perhaps, no single phase of accounting, whether of mining or manufacturing companies, more complex or troublesome than this matter of plant and equipment depreciation; hence nothing in which there are more differences of opinion and method of procedure among operating companies; I might add nothing in which managements and accountants may more easily and with the best intentions deceive themselves and each other. The views, plans and methods herein set forth are, therefore, not necessarily standard—they are more or less the result of my personal study and experience.

Up to the time when a mine is placed on an operating basis, that is when it is ready to produce the daily tonnage for which its development, plant and equipment were planned (regardless of what it actually does produce at that time, determined perhaps by the law of supply and demand, labour or weather conditions or car supply) all expenditures for development, plant and equipment should be charged to construction account with credit to that account for product sold in the full sum realized for the same. After the projected development has been completed and the mine placed on an operating basis, all expenditures made during the whole course of its life, whether for development, air shafts, road extensions, mine cars, mining machines, motors, power houses, power equipment or lines, or anything that may be installed, should be charged to operations, unless such expenditures result in positive increase of capacity, in which case they may be charged to capital investment with a proper regard to the question of the length of time that such additions may reasonably be expected to serve.

Further charges should be made to mining cost monthly in fixed uniform amounts, with credit to a fund account generally known as plant and equipment depreciation fund, for the replacement of capital originally invested in such development, plant and equipment, or for the replacement of units which wear out or become obsolete. The extent to which this fund

*Address to the 16th Annual Convention of the American Mining Congress, Philadelphia, Oct. 20-24, 1913.

may be used for replacements or renewal in kind must be determined by the rate at which the fund is accumulated. If the rate is low and a long period, perhaps the entire life of the mine, is consumed in charging operations with the full amount of the original investment (less salvage) obviously no replacements or renewals should be charged against or paid out of the fund—all must be charged to operations. If the rate be made high enough so that a much shorter period is consumed in getting into the fund the full value of the original investment through charges to operations, certain replacements, renewals, or improvements may be charged against the fund.

The company with which I am connected now follows the uniform rule of charging operations with depreciation of plant and equipment at the rate of 6 per cent. per annum or net (or reducing) values, with credit to depreciation fund. This will cover into the fund about 70 per cent. of the original value in twenty years; it is contemplated that salvage values, that is, the values of all equipment scrapped or removed for use at other points during that period, together with the remainder value, credited to the fund will make up the 30 per cent. or balance of original value not charged to operations in the fixed monthly charges.

We, therefore, do not charge any renewals or replacements against our depreciation fund accumulation, but charge them all to operations. When the charges are so large as to seriously impair monthly comparisons of cost they are spread over the operations of a few months.

Labour.—In the Pittsburgh Coal Mining District labour costs fall into two general divisions, first, that which is paid on a unit basis of work performed, such as the scale rate for pick mining, machine mining subdivided into cutting and loading, and dead work, such as yardage, room turning, break throughs, clay veins, etc., and, second, that which is paid on a per diem basis, such as motormen, drivers, general inside labour, tipple labour, general outside labour, electricians, etc. It would hardly be profitable to follow the subdivisions of labour in this paper—they differ, of course, with changing conditions and according to the viewpoint of the respective operators.

Supplies.—All expenditures for live stock and supplies, after the initial installation at a new mine, should be charged to operations as made, although for purposes of checking and accuracy in monthly comparisons of cost inventories should be taken at the close of each month and entries made debiting inventory account, with credit to operations, for unused supplies at cost and for live stock in the service at a fair valuation.

Fuel.—The mining cost statement at a mine depending upon its own power plant, which does not include a charge for coal consumed in the same is incomplete and apt to be misleading in comparisons with mines purchasing power from central stations. For this reason it is proper to charge the fuel at a representative value to operations, with credit to coal sales account, notwithstanding that operations have already been charged with all the items entering into the cost of the product so consumed. This treatment of the individual power plant fuel of course, must not be lost sight of in the general summary of business done.

Insurance—Fire, tornado, boiler and employer's liability insurance premiums are increasingly important as items to be taken into account in mining costs whether these hazards are covered by insurance companies or assumed by the operator. In the latter case a fund or funds should be created and maintained at a charge to operations in sufficient amount to pay all losses, and, conservatism suggests, to accumulate a reasonable surplus.

General Office Expenses and Other General Expense.—General office expenses and other general expense should be incorporated in mining cost statements in order to get a total outside amount of cost upon which to base selling values; they should, however, be shown separately under appropriate headings, not being included in any of the subdivisions of "Cost at Mine." In a company conducted exclusively as a mining company it is, perhaps, better not to differentiate nicely between that portion of general office expense which is chargeable direct to mining, such as the operating and engineering departments, and the expenses of departments of sales, transportation, finance, accounts, etc. In a broad sense, the base of all the company's business is the production of its mines, hence all of its general office expense may properly be included as a part of its total mining cost.

RELATION OF BIG BUSINESS TO INDUSTRIAL PROSPERITY*

The Sherman Anti-Trust Act was responsible for the tremendous waste in mining through permitting unrestrained competition. When the Sherman Act was passed, immediately the wheels, so far as co-operation was concerned, were turned back to the conditions of the Middle Ages. An interstate trade commission and state trade commissions, which shall have substantially the same power to regulate co-operation in industry that the Interstate Commerce Commissions have in regard to public utilities, should be established. It seems to me that the Interstate and State Commerce Commissions and the administrative bodies for the pure food laws point the way for the next constructive step in the development of the laws. It would, perhaps, be chimerical, with public opinion as at present, to propose the repeal of the Sherman law, but the situation may be met by amendments to this law. The Sherman Act can be left to apply, as defined by the Supreme Court, to monopoly. Unreasonable restraint of trade may be defined as monopolistic restraint of trade, and it is rather generally agreed that monopoly should be prohibited. To make the matter perfectly clear another amendment should allow reasonable co-operation, but such co-operation should be under the watchful eyes of administrative commissions in order to protect the public.

There can be no question that the competitive system, when unrestrained, is positively opposed to the policy of conservation. This is true alike for minerals and timber. The minerals of the earth require the building of the earth for their making. Mineral deposits are doubtless in the process of manufacture at the present time; but even if so, this is at so low a rate as to be negligible. From the point of view of mankind, the stores of minerals in the earth are deposits of definite magnitude upon which we may draw but once and which by no possibility can be increased. In this connection it should be recognized that modern civilization would not be possible without the mineral resources of the earth—no iron ships, no tools except those of stone, no fuel but wood. Without

*Extracts from address before American Mining Congress, Philadelphia, Oct. 2, 1913.

the sub-surface products of the earth we would at once return to the material conditions of the stone age. It is, therefore, incontrovertible that from the point of view of the human race, economic systems or laws which result in unnecessarily rapid use of the mineral stores of the earth are indefensible; but such are the economic theories and laws now dominant in the United tates.

The wastefulness of the competitive system may be proved with regard to every product which is taken from the earth. Lead and zinc in Wisconsin and Missouri are mined on a small scale under an extreme competitive system. The losses of these metals in their mining and metallurgy are nothing short of appalling. In southeastern Missouri, according to the late Dr. Bulkley, not less than 15 per cent. of the metal is left underground; the losses in concentration approach 15 per cent.; the loss in smelting and concentration frequently amount to 15 or 20 per cent.; thus making a total loss of from 45 to 50 per cent. These great losses are due to the system of numerous small holdings, combined with the competitive system. High royalties on the part of the small feeholder are demanded of the operator. The operators desire to get large returns at the earliest practical moment upon this small investment. In consequence, ore is left in the ground that should be mined; unnecessary losses take place in concentration, also unnecessary losses occur in smelting.

But the most disastrous losses in mining as far as the future of the human race is concerned are in connection with coal. Director Holmes of the United States Bureau of Mines, in a paper upon mineral wastes, presents the facts in regard to the ruinous wastes of the unrestrained competitive system in connection with coal. He says that in the early days of mining when there was much sub-division of ownership; that not more than 30 to 40 per cent. of the anthracite coal in the beds mined was brought to the surface, leaving from 60 to 70 per cent. in the ground. He states that even at the present time that not more than 50 per cent. of the anthracite reaches the surface. The situation is similar for bituminous coal, but until recently the losses for such coal was substantially half. This loss has been somewhat reduced, but it continues to be appalling. Holmes estimates that since the beginning of mining in the United States, "two billion tons of anthracite and three billion tons of bituminous coal have been left underground in such condition as to make its future recovery doubtful or impossible." The principles which from the point of view of conservavation should apply to the mining of coal are well known. So far as practicable the mines should be so worked as to make one superimposed vein after the other available. Coal slack should be reduced in amount and utilized. No considerable percentage of coal should be left in the ground as pillars. If these reforms were introduced, the losses could be reduced to half the present amounts and possibly to one fourth.

But to ask that any such proposals should be put into operation is purely chimerical. Under the Sherman law there is no opportunity to limit output, divide territory, or regulate prices. Five thousand bituminous operators could produce two hundred millions of tons of coal per annum beyond present demands. If the operators could agree upon limitations of output, and division of market so as to reduce freights, and could arrange for reasonable prices, which would give them no more than their present profits, they would then be able to follow these principles in mining their coal; for they themselves would be gainers in prolonging the life of their mines, and far more important many future generations would be the immeasurable gainers in that they would have an adequate coal supply.

Under the competitive system, we are recklessly skimming the cream of the natural resources of a virgin continent with no regard for the rights of our children or our children's children. They will have a heavy score against us if we continue to ignore the future and to apply the unrestrained competitive system in total disregard of their rights.

My proposal to remedy these conditions is neither regulated competition, nor regulated monopoly, but retention of competition, prohibition of monopoly, permission for co-operation, and regulation of the latter. At the present time there are state and notional movements to still further extend the advantages of co-operation to the farmers. Since it is unquestionable that the sense of justice of the citizens of the United States will support the courts in prohibiting class legislation, we shall therefore, I believe, ultimately permit co-operation in all lines of business alike. If we, however, retain freedom of competition, permit concentration sufficient to give efficiency, allow reasonable co-operation, and prevent monopoly, this will require regulation just as it has been necessary to regulate the railroads. This done, the Sherman law will be forgotten. Has there been any prosecution of the railroads for violation of the Sherman law because of collusion in fixing rates? And yet, everyone knows that they are just as flagrant violators of the Sherman Act as any other class of corporations in the United States. Are the freight rates the same for different roads between any two points? Are the passenger rates between Philadelphia and Chicago identical on all roads? Can you do better in price by travelling over the Pennsylvania, than over any other road? The rate is the same providing the speed is the same. How does it happen that the roads all got together? Just by Providence, I suppose. It was doubtless by a providential act that these rates were fixed identically upon all the roads, under the same conditions, all over the country.

Why is it that nobody proposes to indict the railroads for collusion? Simply for the reason that the rates which they can charge are controlled by commissions, national and state. Nobody any longer wishes to make them further trouble, because the public is protected by its commissions. The railroads are just as amenable to attack under the Sherman Act as any other combination in the United States. but when the railroads are giving reasonable rates, and are competing in giving reasonable service, even if the law is on the statute book and is the hallowed thing that has been described—the sense of official justice is such that they are not attacked in the courts. Will the Attorney-General of the United States or the Attorney-General of this or any other state, bring suit against the railroads for conspiracy in fixing rates when the public is properly protected? I have not heard the proposal made anywhere.

Minnesota and Wisconsin men have arranged to purchase the Second Relief gold mine and 10 stamp mill in Erie camp, Nelson mining division, B.C., and have commenced to clean up around the mine preparatory to working it. Mr. Edward T. Seaman, from Wisconsin, is in charge of the work being done.

PERSONAL AND GENERAL

Mr. H. S. Lavery who recently returned from South America is now at the Porcupine Pet Mine, South Porcupine.

Mr. D. A. Thomas who has been negotiating important railway and mineral land projects in the west, has returned to England.

Mr. Ambrose Monell and Mr. W. W. Mein are in Northern Ontario visiting the properties of the Canadian Copper Company and the Dome Mines Company.

The 40th annual commencement of the Colorado School of Mines was held on Friday, May 22nd.

Canadian Allis-Chalmers, Limited, has issued a bulletin on turbine pumps.

Dr. Joseph Struthers has accepted the office of second vice president of the Johnson Electric Smelting, Inc., controlling the American rights of the Johnson electrothermic process for the treatment of zinc ores and zinciferous lead and copper ores, with offices at 18 East 41st Street, New York, N. Y.

Mr. A. J. Tonge, the Mining Engineer of the Dominion Coal Company, left Halifax for England on the 2nd May, and will be away for about six weeks. During his visit Mr. Tonge hopes to visit several new developments in mining practice in England and on the Continent, on behalf of his Company.

H. W. Johns-Manville Co. has issued a bulletin on paints suitable for use in and about mines.

Mr. Fritz Cirkel has made an examination of the asbestos and chrome properties of the Black Lake Asbestos and Chrome Co., at Black Lake, P. Q.

Mr. Geo. H. Aylard, general manager for the Standard Silver-Lead Mining Co., has been at Sol Duc Mineral Springs, in the Olympic Mountains, in the State of Washington.

Dr. A. E. Barlow has returned East from a visit to Nelson, Trail, and Victoria, in British Columbia, and Banff, Alberta.

Mr. H. C. Bellinger is at Spokane, Washington, having returned to the United States after resigning the position of general manager for The Great Cobar Mining Company, operating mines and concentrating and smelting works in New South Wales, Australia. Mr. Bellinger was in that country about five years.

Mr. Thos. Graham, chief inspector of mines for British Columbia, has arranged to attend the annual convention of The Mine Inspectors Institute of the United States of America, to be held shortly at Pittsburgh, Pennsylvania. He has been requested to allow himself to be placed in nomination for election as a vice-president of the institute.

Mr. J. Cleveland Haas, for years resident in Spokane, Washington, has removed to the Bozeman district of Montana, where he has charge of a placer-gold mining enterprise.

Capt. Harry Johns, who for two or three years had been superintendent of the British Columbia Copper Mining Co.'s mining operations in Nelson and Slocan Lake districts, recently returned to Nelson after having been about four months in California recuperating following convalescence from a serious illness with pneumonia.

Mr. Woolsey McA. Johnson, of Hartford, Connecticut, was recently at Nelson and Trail, British Columbia, looking into the prospects for establishing in West Kootenay district, a small electric zinc-smelting plant to demonstrate the commercial value of a reduction process he has patented.

Mr. Chester F. Lee, of Seattle, Washington, recently again visited the Tulameen district of British Columbia. It is stated that he will direct placer mining operations for gold and platinum on ground on Tulameen River below the junction of Rock Creek with the larger stream.

Mr. Dudley Michel, of South Wellington, Vancouver Island, formerly of the Crows Nest district, in Southeast Kootenay, has been appointed instructor in "first aid to the injured" for the British Columbia Department of Mines, and in that capacity will visit both metal and coal mines and give demonstrations of and instruction in first aid work, following the course of the St. John Ambulance Association. At the suggestion of the secretary of the Western Branch of The Canadian Mining Institute, the Chief Inspector of Mines arranged that Mr. Michel should give his first public address at the meeting of the branch called for May 28th, in Nelson, B. C.

Mr. L. B. Reynolds has returned to Nelson, B. C., after having spent several months in Ontario.

Dr. Joseph Struthers, of New York, recently accompanied Mr. Byron E. Eldred, president of the Johnson Electric Smelting, Incorporated, on a business visit to British Columbia.

OBITUARY

Mr. W. J. Sutton, of Victoria, B. C., who died suddenly on the morning of May 9 at Ucluelet, on the west coast of Vancouver Island, was a well-known geologist and mineralogist. He was born at Kincardine, Bruce County, Ontario, on January 19, 1859. After having attended the public schools for a number of years, he took courses in mining and geology at Trinity College, Cornell; Columbia School of Mines, New York; and the Michigan College of Mines, Houghton, Michigan, at which last mentioned institution he has been for some time an instructor in geology. His residence in Victoria, B. C., dates back to 1877. In the late eighties he was Provincial Government Assayer, and in connection with that office examined and listed many minerals occurring in the province. The Annual Report for 1888 of the Minister of Mines for British Columbia includes a comprehensive report by Mr. Sutton on several of the then known mining districts, and a list of minerals that had come under his notice in the performance of the duties of his office. On leaving the public service he joined the staff of the Dunsmuirs, then largely interested in coal-mining on Vancouver Island and owning an extensive area of land on the island acquired in connection with the construction of the Esquimalt & Nanaimo Railway. Much work was done by Mr. Sutton ascertaining the geological features of the E. & N. railway belt, so that he became particularly well informed concerning the geology of Vancouver Island and as the years passed placed on record much valuable information relative to the topography, geology, and mineral resources of various parts of the island. His work in this connection included the preparation of a large map of the island, which, however, was primarily for the information and use of the Dunsmuir interests, though now and then Mr. Sutton showed it when

addressing audiences, as he did occasionally, on the geology and mineral resources of the island. Fortunately, for five or six years immediately prior to 1913 the Geological Survey of Canada had either topographical or geological parties in the field on the island, and as Mr. Sutton gave to those in charge freely of his knowledge of local features and conditions, there was made available for the benefit of the public much information that might not otherwise have been readily accessible.

Apart from his geological work, Mr. Sutton made a hobby of collecting specimens of mineral and succeeded in getting together what is probably the finest and most valuable collection in the Northwest. He took great pleasure in showing his mineral treasures to those well enough informed on the subject to appreciate their worth. At times he would give his fellow members of the Natural History Society of Victoria the benefit of a talk on minerals and show them many specimens of interest and value. He was a member of the American Institute of Mining Engineers, a vice-president of the Canadian Mining Institute, and belonged also to other societies.

SPECIAL CORRESPONDENCE

BRITISH COLUMBIA

Much interest has been taken in the district about Nelson in the visit during the early part of May of leading officials of the Johnson Electric Smelting Co., who were invited by the Nelson Board of Trade to investigate the situation in Kootenay with a view to establishing an electric smelting works in the district to treat lead-zinc ores. Particulars of the negotiations that were carried on will be given on other pages of the Canadian Mining Journal.

The 1914 mining season in districts where there is a heavy snowfall in the winter is now fairly entered on, and information has been received from various camps telling of renewed activity, together with good prospects for the year. In the placer-mining districts, too, much preparatory work has been taken in hand, and generally there is confidence that the year will see production to a similar extent that characterized operations in 1912 and 1913, in each of which years the total value of the mineral produced exceeded that of any year prior to 1912.

Standard Silver-Lead Mining Co.—A statement showing the receipts and expenditures of the Standard Silver-Lead Mining Co. for the month of March has been issued to stockholders. The company operates the Standard Silver-Lead-Zinc mine situated about two miles from Silverton, Sloean Lake. Net receipts for ore shipped totalled $107,253, and from the boarding house there was received $4,511. Operating expenses were $23,539, and expenditures on capital account $7,467. The net profit for the month was, therefore, $80,758. The monthly dividend No. 25, of $50,000—was paid, which left $30,758 to be added to the company's credit balance, bringing the latter up to $324,090 as at March 31.

A statement recently sent to stockholders in the Standard Silver-Lead Mining Co., shows that during the calendar year 1913 receipts from all sources totaled $1,071,692, as follows: From ore shipped (13,959.54 tons) $949,245; final settlements and umpires, $180; lead bounty (paid by Government of Canada), $15,764; zinc concentrates, $65,890; boarding house, $38,168; interest, $2,445. Expenditures totaled $340,467, of which $253,457 was on operating and $87,010 on capital account. The net profit for the year was $731,225, of which amount $650,000 was distributed as dividends. Adding the remainder—$81,225—to the balance at credit on January 1, 1913—of $165,123—the current year opened with a credit balance of $246,348. Shipments of silver-lead ore and concentrate in 1913 totaled 13,960 tons, the average metal contents of which were 77.5 oz. per ton (total, 1,081,849 oz.) and lead 64.4 per cent., (total, 17,988,805 lb.). There was also shipped 4,375 tons of silver-zinc concentrate which averaged 24.3 oz. of silver to the ton and 41.92 per cent. zinc. Total shipments by the company from the time it commenced production operations on December 1, 1911, to December 31, 1913, a period of 25 months, were as follows: Of silver-lead products, 24,536 tons, averaging 77.1 oz. silver to the ton (total, 1,893,673 oz.) and 64.1 per cent. lead (total, 31,486,065 lb.). Of silver-zinc concentrate, 8,046 tons averaging 23.4 oz. of silver to the ton (total, 188,744 oz.) and 41.6 per cent. zinc (total, 6,696,691 lb.).

Comparing the average metal value of the silver-lead products in 1912 with that in 1913, there is little difference, for in the former year it was 76.2 oz. silver to the ton and 63.8 per cent. lead, while in the latter it was 77.5 oz. of silver and 64.4 per cent. lead. There was also a small increase in the average metal contents of the silver-zinc concentrate—silver 24.3 oz. to the ton and zinc 41.92 per cent. for 1913, as compared with silver 23.4 oz. to the ton and zinc 41.6 per cent. for the whole period of production.

Boundary.

Granby—During the first week of May there was treated at the Granby smelting works at Grand Forks 22,756 tons of ore, of which 22,362 tons was from the company's mines at Phoenix and 394 tons was of custom ore. The week's shipments of blister copper to the refinery totaled 174,000 lbs., making the total for the year 7,074,652 lb.

Published figures for four months, January-April, of this year show that the total quantity of ore treated at the Granby works during this period was 401,246 tons, of which 393,249 tons was from the company's own mines in Boundary district and 7,997 tons was of custom ores. No particulars are available as to the sources of the latter, though it is known that mines in Republic Camp, Washington, ship to the Granby smeltery. Blister copper shipments from the works to an eastern refinery during the four-month period have totaled 6,900,652 lb. The figures for this year show a small decrease as compared with those for the corresponding period of last year, when they were as follows: Ore from Granby Co's mines treated, 410,631 tons; customs ores, 3,679 tons; total, 414,310 tons, The blister copper shipped to May 1, 1913 totaled 7,394,697 lb.

Similkameen.

Hedley—The dam across Similkameen River in connection with the Hedley Gold Mining Co.'s new hydro-electric power system, for which the directors some time ago made an appropriation of $200,000, is now nearly completed. The erection of this dam was commenced late last autumn, and now all that remains to be done is a small portion of the upstream aprons, which work must be deferred until the spring freshets in the river shall have passed. The ditch and flume

line are now having attention and the work on these is well advanced, both in clearing and grading the line and in preparing timbers for the flume. Meanwhile production of ore at the mine and its reduction in the company's 40-stamp mill are being continued as usual.

Placer mining for gold and platinum on parts of the Similkameen and Tulameen Rivers is to be actively engaged in this year, to a larger extent than for several recent years. One enterprise is in charge of Mr. Chester F. Lee, of Seattle, Washington, who has arranged to give it much of his time. The ground to be worked is on the Tulameen, below Granite Creek. Mr. R. A. Lambert will continue his work on Granite Creek, just above the junction of the north fork with the main creek, where he and his associates have put in a dam and sluice-flume.

Tulameen.

A Spokane, Washington, syndicate is persevering in developing its property on Treasure Mountain, Summit Camp, near the headwaters of Tulameen River. There being no wagon-road connection nearer than 16 or 17 miles from the camp—only a trail the grade of which is steep in places—work is being done under difficulties, but a low-level crosscut adit is being driven with the object of proving whether or not the well-defined and ore-bearing vein that can be traced for a long distance on the surface continues down to the depth at which the adit is being driven. Some silver-lead ore has been found, but it is believed the vein sought for is farther ahead. In an upper tunnel, driven about two years ago, there was opened a vein in which galena occurs in places, ranging in width up to 14 inches, with concentrating ore between and about the shoots of clean ore. The Treasure Mountain syndicate claims to have expended about $20,000 in connection with the development of its group of mineral claims, while other Spokane men have spent smaller sums in the camp, notably on the Indiana claim, in which an adit has also been driven, with silver-lead ore occurring in places along its length of 300 ft. or more. Mr. Patrick Clark, of Spokane, last year bonded a number of claims in the camp, but as yet he has done but little development work on them.

QUEBEC

At the asbestos and chrome properties of the Black Lake Asbestos and Chrome Co., in Black Lake, P. Q., five pits are in operation. There is employed a force of 225 men. About 700 tons of asbestos rock is raised daily. Only half of the mill is in operation now, but the other unit will be operated also as soon as the big ore bin, to hold several thousand tons of asbestos rock, is completed.

The graphite deposits at Elmsley, Ont., which were extensively operated several years ago, will be taken over by Pittsburgh people. The mill will be overhauled and its capacity, which is now 60 tons per day, increased to 100 tons. About six per cent. of graphite is extracted by the present machinery. This will be increased to eight per cent. by the installation of some new separation tables. These properties were intermittently operated for the last 20 years. Diamond drill borings have shown that the extent of the deposits is great.

PORCUPINE, SWASTIKA AND KIRKLAND LAKE

Dome—At first sight the Dome annual report is frankly disappointing to shareholders; but on fuller examination it presents many redeeming features. The fullest information is vouchsafed and the most inquisitive stockholder cannot say that he has not been taken into the confidence of the directorate.

Mr. W. W. Mein states his average grade of ore at $3.80 per ton and this is regarded as uncomfortably low unless the ore bodies are so enormous as to permit of handling very large tonnage so as to reduce costs to $2.50 or less a ton. Fortunately both developed and indicated ore as stated in the report tends to prove that the ore bodies will be large enough to permit of very economical handling.

The management believes that with the extension of the mill and the alteration in the process the costs per ton can be reduced to $2.50 or even lower, and if this intention can be realized the ore will yield a handsome profit.

Certainly it is the general opinion that if the Dome can make a good profit on $3.80 a ton it opens a field for the operation of low grade ore bodies in Northern Ontario, which should cause the investment of considerable capital in low grade deposits, which have so far been considered too low to treat at a profit.

During April the tonnage treated in the mill was lower, but the recovery was higher indicating that the grade ran better. It is extremely difficult to maintain the grade of the ore at anything like an even level as only the most careful examination will indicate even a relative value.

It is pointed out in the annual report of Mr. A. A. Cole, mining engineer of the Temiskaming and Northern Ontario Railway, that the gold production of the Porcupine camp in the year 1913 was an increase of 147 per cent. over the previous year. Porcupine according to official figures produced 95 per cent. of the Ontario gold and 29 per cent. of the amount taken out of the ground in the Dominion.

Jupiter—The McKinley Darragh Savage Mining Company has lost no time in getting to work upon the Jupiter. The directors of the Cobalt company visited the Porcupine mine last week and were satisfied with the progress made. According to their sampling there is on the 300 ft. level 300 ft. of ore which will run $15 for a width of 36 to 42 in. Drills are at work on both ends of this ore body. Above the 300 ft. level the ore bodies are short and irregular. The winze has been sunk to the 400 ft. level and a crosscut has been started to the north. A vein has been cut, which may or may not be the main vein. It is 5 ft. wide, but runs only about $6 to the ton. To the south the crosscut has just run into a narrow ore body which panned gold and appeared to be quite rich. At the time of writing exact assays had not been received. The company has leased the compressor plant of the Plenaurum, which will give sufficient power for the present and until such time as they desire to prosecute operations upon a larger scale.

Porcupine Crown—In the month of April the mill at the Porcupine Crown treated 3,500 tons of ore of a value of $18 per ton. Of this the mill recovered 97 per cent. with very creditable costs considering that only about 100 tons per day is being treated.

At the 500 ft. level the vein which has so far been drifted upon is by no means of as good a grade as on the upper levels. It will be remembered that the main

vein dipped out of the winze at a depth of 450 ft. and that the winze was carried on down vertically to the 500 ft. From the bottom of the winze a crosscut was carried across to the vein, which when cut was not of a grade as high or nearly as high as on the upper levels. But on the 450 ft. level the vein has already been developed in good ore for 100 ft. and drifting will be continued south to the fault. On the 400 ft. level the ore shoots developed amount to about 400 ft. The body is divided into two shoots by a lean patch of about 150 ft. It is the intention to sink a winze on ore from the 400 ft. level to the drift on the 450 ft. and thence down to 500 ft. with the intention of discovering exactly where the break in the vein occurs.

Dome—The production of the Dome Mines, Porcupine, during April was: Tonnage milled 14,770; value gold produced $97,454.

The total tonnage milled for the twelve months ending March 31, was 145,210 tons, and the total amount of gold recovered, $1,204,263.

In Munro Township prospectors have been stirred by the spectacular showing of the Dobie Leyson property. The vein is stated to have an approximate width of from 5 to 7 ft. There is much visible gold and also sulphides.

The owners of the Agate gold property, which is in the same section, have recently made a mill run of 30 tons of ore in the Detroit syndicate's small mill. The test is said to have been satisfactory and to have decided the company to proceed with development on a more extended scale.

Vipond—The first work the new company that has taken over the Vipond will undertake, will be the reconstruction of the mill. The crushing section of the mill will not be altered very extensively, but it is proposed to add equipment similar to that in use at the Porcupine Crown where the continuous decantation process has proved so successful. After the mill has been put in shape underground work will commence. It is understood that the control of the company will be held by the majority shareholders of the old company. Shares will be apportioned to old shareholders at a ratio of 3 new for 8 old. A block of stock has been sold to a Toronto brokerage firm, and it is estimated that the money so raised will provide the funds necessary to put the mine in good running condition. The Vipond mine has been closed down since the labor strike in September 1912. At that time there was trouble with the mill, the recovery on the plates not being at all satisfactory. When the strike was declared the mine was closed down and has been so closed ever since. Mr. C. H. Poirier, who had charge of the property before, is again manager of the property and will attend to the reconstruction of the mill.

Porphyry Hill—Last month the Porphyry Hill property shipped another car of ore taken from an open cut on one of the old Preston East Dome claims, which lapsed to its original owners. The shipment consisted of 51,700 lb.

Alexo—From the Alexo mine no less than 582 tons of ore left the mine during the month. It is learned that in the drift at the 80 ft. level the ore body has widened considerably. This will probably induce the owners to run a spur line into the property and open up the mine on a larger scale.

COBALT, GOWGANDA AND SOUTH LORRAIN

Keeley—Dr. J. Mackintosh Bell, the representative of the Huronian Belt company, the Canadian Corporation of Messrs. Ehrlich and Co., and allied interests, is reported to be quite pleased with the developments on the Keeley mine in South Lorrain. He has been spending some time at this property, which has recently been re-opened after being closed down for the whole of the winter.

The ore shipments for the month of April showed an advance of almost 300,000 pounds in comparison with the previous month of this year, although the record is still considerably short of the corresponding period last year. The Chambers Ferland appeared on the shipping list again after a lengthy absence. There were no less than 17 mines shipped ore in April.

The shipments for the month of April in pounds were:

Beaver Consolidated	62,435
Chambers-Ferland	58,690
Crown Reserve	40,000
City of Cobalt	75,740
Cobalt Townsite	356,940
Coniagas	301,750
Cobalt Lake	193,620
Dominion Reduction	518,360
Hudson Bay	154,610
La Rose	191,840
McKinley-Darragh	379,480
Nipissing	115,370
O'Brien	63,760
Penn-Canadian	63,760
Peterson Lake (Seneca Superior Lease)	68,210
Trethewey	95,860
Temiskaming	49,800
	2,811,045

Kerr Lake—Ore reserves at the Kerr Lake mine are being drawn upon only to the extent of keeping production high enough to enable the company to pay current dividends. It is the purpose of the present mine management to maintain development of unproven territory at least at an equal pace with the stoping of known ore reserves. The ore in the Fleming vein at the Kerr Lake mine proved to be profitable farther below the contact and in the Keewatin than any other mine in the camp. To the 325 ft. level, or approximately 100 ft. below the bottom of the conglomerate the ore is of excellent milling grade, but at the 325 it is lean. As a rule in most mines in the camp the veins carry little silver below the contact.

The big vein, known to exist at the 140 ft. level, but not exhibited on the surface until last year when the lake was drained, has not been touched yet. Ore from it will be pulled from time to time as it is required, but it is yet as intact as it was nine months ago.

The fact that the power company is overloaded prevents the running of more than one of the two pumps now being used to drain the lake. This pump is only running at nights and is now pumping mud only, the lake being almost entirely dewatered.

La Rose—All the old board of the La Rose was re-elected at the annual meeting in Montreal. In the annual report Mr. R. B. Watson, general manager, clearly indicates that more ore will soon have to be found to maintain the present position of the company. Milling ore on the dumps was scarcely touched during the year, the contract with the Northern Customs mill being filled with ore from development; but the high grade reserve was cut in two. Both the Lawson and the Princess are now contributing more to the production of the company than the old La Rose, where a very vigorous development campaign is being carried on near the Cobalt Lake fault. Results to date have been negative. A good feature of the report was the reduction in costs by 3.13 cents an oz., though the net gain was only 79c an oz., owing to the fall in the price of silver. Dividend requirements call for $931,000 during the year. The net surplus has been increased to the large total of $1,528,776, the company not finding any of the prospects examined sufficiently alluring.

Gould—The General Assets Limited of Toronto, of which Mr. Garnet Grant is president, has made first payment on the control of the stock of the Porcupine syndicate, and since the Porcupine syndicate has control of the Gould Consolidated stock, the General Assets is now in charge of the Gould lease, the Cart Lake, Several short shoots of high grade ore have recently been discovered on the Gould. The General Assets once had the control of the Dome Lake, at Porcupine, but sold out to the Hudson Bay. They still are running the Cochrane mine near the Temiskaming mine in south east Coleman.

The Seneca Superior Mine Co., Limited, has declared its regular quarterly dividend of 10 per cent. with two and a half per cent bonus. The bullion shipments from the Cobalt camp for the year now amount to more than two million dollars.

The Trethewey Cobalt Mining Company has taken an option on 120 acres in Harris township, about a mile south of the Casey Cobalt mine. The overburden is for the most part heavy and the only method of prosecuting is with the diamond drill. Two drills will be set up in various places and the formation will be tested, it being hoped also that veins may be encountered. The claims form part of a plateau between two ridges of rock rising out of the Clay Belt along the shore of Lake Temiskaming.

The whole of the acreage is in the conglomerate.

ALASKA SOLOMON DERBY DOG RACE.

The first of the dog races of the 1914 season—the Solomon Derby—over the snow trail from Nome to Solomon and return, was run on March 2. The competitors were Fred Ayer, who finished first; John Johnson, A. A. (Scotty) Allan, driving a team of malumets owned by himself, and Mrs. C. Darling, of Berkley, Fay Dalzene, winner of last year's All-Alaska Sweepstake, driving dogs owned jointly by himself and Russell Bowen, and Percy Blatchford.

The five teams started from Nome at 10 o'clock in the morning under a clear sky, but a wind and snowstorm that became almost a blizzard as the race proceeded made the going heavy, so that there was no chance of beating the best record of other years. Fred Ayer finished the course of 64 miles in 6 hours, 30 minutes and 4 seconds. John Johnson, winner of the 1913 Derby, was a close second with his team of Siberian wolves, finishing two minutes after Ayer. Johnson's time last year, which was the record of this course, was 5 hours, 47 minutes, 24 seconds.

The All-Alaska sweepstake, 412 miles, from Nome to Candle and return, will take place in April. The contestants in the long races must finish with the same dogs and equipment as at the start. If a dog is disabled, he must be carried on the sledge. Winners in either of the big derbies are honored for the remainder of their lives.

The introduction of the reindeer and the promise of railroads have not affected the place of the Eskimo dog as the chief transportation agent in northern Alaska. The sledge dog has as many points to be considered as a blooded horse, and when Stefansson brought dogs here last summer for his Arctic expedition he picked them as carefully as he had previously selected his men.

COBALT ORE SHIPMENTS.

The ore shipments for the week ending May 22 were about the same as they have been for the past six or seven weeks in spite of the fact that only six mines were on the shipping list. This is explained by the fact that the McKinley-Darragh shipped no less than five cars of ore during the week. One of these had been sent previously to Campbell & Deyell's to be sampled so that it had actually been produced some time before. It ran about 2,500 oz. for 33½ tons. The Cobalt Townsite shipped two cars and the Casey Cobalt and the Cobalt Lake, one each. The mine belonging to the Rose Van Cutsem group in London is reported locally to be in much better shape than the sudden drop of the stock in the London market would indicate.

The ore shipments from the Cobalt camp for the week ending May 22 were:

	High.	Low.	Total lb.
McKinley-Darragh	341,305	....	341,305
Cobalt Townsite	162,200	....	162,200
Nipissing	....	121,330	121,330
Dominion Red	....	86,160	86,160
Cobalt Lake	63,770	....	63,770
Casey Cobalt	....	63,700	63,700
	567,275	271,190	838,465

TOUGH-OAKES.

Cobalt, May 23.—The bush fire which destroyed some poles on the Charlton-Swastika Kirkland Lake transmission line did not materially alter the date of the turning on of power. At the Kirkland Lake end of the line everything is in readiness and has been now for some time. It is hoped that the power may be turned on next week, but there are always so many unexpected factors to consider that it is not certain.

The Tough-Oakes has shipped another car of ore of the usual value, viz., about $400 to the ton. Drifting on the main vein has started at the 300-ft. level.

As an indication of the interest that a group of mining men are taking in the Kirkland Lake field, it is known that a representative of the Central News Agency of London, England, made a special journey to Kirkland Lake and cabled some 300 or 400 words to England at the request of the firm by whom he was employed.—Cobalt Nugget.

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

May 26, 1914.

New York Curb.

	Bid.	Ask.
Alaska Gold	28.25	28.50
British Copper	1.50	2.00
Braden Copper	7.75	8.00
California Oil	308.00	311.00
Chino Copper	41.25	41.50
Giroux Copper	.50	1.00
Green Can.	31.00	33.00
Granby.	.....	.....
Miami Copper	21.75	22.25
Nevada Copper	14.50	14.75
Ohio Oil	185.00	186.00
Ray Cons. Copper	21.37	23.50
Standard Oil of N. Y.	219.50	221.00
Standard Oil of N. J.	407.00	409.00
Standard Oil (old)	1050.00	.....
Standard Oil (subs)	945.00	.....
Tonopah Mining	6.37	6.62
Tonopah Belmont	7.12	7.37
Tonopah Merger	.57	.59
Inspiration Copper	16.50	17.25
Goldfield Cons.	1.43	1.50
Yukon Gold	2.75	2.87

Porcupine Stocks.

	Bid.	Ask.
Apex.	.02¾	.03½
Dome Extension	.08	.09
Dome Lake	.41	.42
Dome Mines	10.20	10.40
Eldorado.	...	...
Foley O'Brien	.30	.32
Hollinger.	16.40	16.60
Jupiter.	.11	.12
McIntyre.	.27	.30
Moneta	.02	.04
North Dome	...	...
Northern Exploration	2.25	2.75
Pearl Lake	.03½	.04¼
Planaurum.	.50	.60
Porcupine Vipond	.28	.32
Imperial.	.01¾	.02
Porcupine Reserve	...	...
Preston East Dome	.01¾	.02
Rea.	.10	.20
Standard.	...	...
Swastika.	.01	.01¼
United.	...	...
West Dome	.06	.10
Porcupine Crown	.83	.87
Teck Hughes	.08	.10

Cobalt Stocks.

	Bid.	Ask.
Bailey.	.01¼	.01½
Beaver.	.28¾	.29
Buffalo.	1.15	1.20
Canadian.	.08	.10
Chambers-Ferland.	.19	.20
City of Cobalt	.46	.50
Cobalt Lake	.41	.50
Coniagas.	7.15	7.75
Crown Reserve	1.30	1.31
Foster.	.04	.06
Gifford.	.02½	.03
Gould.	.01¾	.02
Great Northern	.08	.09
Hargraves.	.01	.02
Hudson Bay	75.00	78.00
Kerr Lake	4.50	4.55
La Rose	1.38	1.40
McKinley.	.67	.75
Nipissing.	6.05	6.25
Peterson Lake	.38	.38½
Right of Way	.04	.05
Rochester.	.01	.02
Leaf.	.01	.02
Cochrane.	.35	.50
Silver Queen	.01¾	.02
Timiskaming.	.15	.16
Trethewey.	.18	.20
Wettlaufer.	.05	.05½
Seneca Superior	2.50	2.85

TORONTO MARKETS.

May 26.—(Quotations from Canada Metal Co., Toronto).
Spelter, 5¼ cents per lb.
Lead, 5¼ cents per lb.
Tin, 36 cents per lb.
Antimony, 8½ cents per lb.
Copper, casting, 15 cents per lb.
Electrolytic, 15 cents per lb.
Ingot brass, 10 to 15 cents per lb.

May 26.—Coal—(Quotations from Elias Rogers Co., Toronto).
Anthracite, $7.50 per ton.
Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

May 22.—Connellsville coke (f.o.b. ovens).
Furnace coke, prompt, $1.80 to $1.90 per ton.
Foundry coke, prompt, $2.35 to $2.65 per ton.

May 22.—Tin, straits, 33.25 cents.
Copper, Prime Lake, 14.37½ to 14.50 cents.
Electrolytic copper, 14.10 to 14.20 cents.
Copper wire, 15.25 cents.
Lead, 3.90 cents.
Spelter, 5.10 to 5.20 cents.
Sheet zinc, (f.o.b. smelter), 7.00 cents.
Antimony, Cookson's, 7.25 to 7.35 cents.
Aluminum, 17.75 to 18.00 cents.
Nickel, 40.00 to 45.00 cents.
Platinum, soft, $43.00 to $44.00 per ounce.
Platinum, hard, 10%, $46.00 to $47.50 per ounce.
Platinum, hard, 20%, $49.00 to $51.50 per ounce.
Bismuth, $1.95 to $2.15 per pound.
Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York cents	London pence.
May 9.	58⅞	27 1/16
" 11.	58¾	27
" 12.	58½	26⅞
" 13.	58⅝	26 15/16
" 14.	58⅝	26 15/16
" 15.	58⅝	26 15/16
" 16.	58½	26⅞
" 18.	58½	26⅞
" 19.	58	26⅝
" 20.	57⅝	26½
" 22.	57½	26 7/16

Put Your Factory Equipment Needs Up to

GOODYEAR
TORONTO

Goodyear factory equipment has established a new efficiency standard in large and small manufacturing concerns throughout the Dominion.

Where "price" used to be the basis of purchase in these places, it is now *SERVICE.*

Belting now is bought on *service rendered* and *operating economy effected.* So is Hose. So are Packing and Valves. Manufacturers are buying Goodyear equipment because they know that they can get the very article for the very need—based on an actual investigation and study of the very requirement.

And in buying factory equipment this Goodyear *efficiency service* is yours without extra charge.

Belting

Transmission Belts that deliver all the power without undue strain on the pulleys and "coal pile." Each belt made to meet the very purpose for which it is designed. Each made for "pulling" power—without unnecessary bulk and weight.

"Leg" and "Bucket" Conveyor Belts. For carrying heaviest loads—coal, gravel, ore, grain, etc. Each made with the exact surface for the exact purpose. Carry the load with least wear and tear. Day in and day out utility insures real economy.

Special Brick Conveyor Belt—with oil-resisting stock face. Unaffected by oil that is shed by machine.

Tell Goodyear your belt needs. Learn beforehand of just the belt, *and why.* Then, no after regrets—no after expense.

Hose

Steam Hose, Air Drill Hose, Agricultural Hose, Hose for gas, acids, and hot and cold liquids. Each made with the special inner lining for its particular purpose. Hence, longer life—*greater service.*

Let Goodyear tell you of just the hose you need. Perhaps you have not thought much about it before. But it's a vital matter just the same, if you value time and money saving. Goodyear has already solved just such hose problems as yours.

Packing and Valves

Poor packing may serve today—and tomorrow. But it soon gives out. That means lost time—lost motion—expense.

Goodyear Packing gives you a tight joint whether the pressure is air, hot or cold water, or superheated steam. Will not blow out. Unaffected by expansion or contraction. Won't flow under intense heat or pressure.

Goodyear Valves are made for all purposes—from cold water to acids—low pressure and high pressure, air and steam. We will tell you the "why" of just the Goodyear packing and valves for your every purpose.

Use This Free Service Asking questions about your belting, hose, packing and valve needs, costs you nothing—involves no obligation. The Goodyear Efficiency Bureau will be glad to confer with you at any time. Write today.

THE GOODYEAR TIRE & RUBBER COMPANY OF CANADA, LIMITED

Head Office: Toronto, Ont. **Factory: Bowmanville, Ont.**

(33)

Fairbanks Springless Dial Scales

The illustration shows Dial Attachment for Dormant Warehouse Scales.

Dial 30" in Diameter.
Graduated 1000 lbs. x 1 lb.
Auxiliary Beam, capacity 2000 lbs.
Tare Bar, 500 lbs. x 1 lb.

¶ With a Fairbanks Dial Scale You Can Decrease your Weighing Time to a Minimum.

¶ These dials are made in Canada and are specially designed for this climate. ¶ They are springless and are not affected by temperature changes. ¶ They can be attached to any Dormant Warehouse Scale and, in this day of progressive methods, should be used in every plant.

Write at once for complete information

The Canadian Fairbanks-Morse Co. Limited

Montreal, St. John, Quebec, Ottawa, Toronto, Hamilton, Fort William
Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver, Victoria

Canada's Departmental House for Mechanical Goods

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & Deyell
Heys, Thos. & Son

Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd

Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO. CANADA.
Phone M, 129. Code: Bedford McNeill

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont
General Manager, Natural Resources Exploration Co., Limited.

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel". Phone Main 6737

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place - New York City
General Manager
Consolidated Arizona Smelting Co.,
Humboldt, Ariz.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O BOX 763

GRAHAM STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

JOHN V. N. DORR
Consulting and Metallurgical Engineer
30 Church Street - New York City
and
First National Bank Building,
Denver, Colorado.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

What is your specialty ?
What is your address ?
Our readers want to know.

LAWYERS

Telephone Main 3813
Cable Address: "Chadwick" Toronto Western Union Code
E. M. Chadwick, K.C
David Fasken, K.C.
M. K. Cowan, K.C.
Harper Armstrong
Alexander Fasken
Hugh E. Rose, K.C.
Geo. H. Sedgewick.
James Aitchison
Beatty, Blackstock, Fasken Cowan & Chadwick
Barristers, Solicitors, Notaries
Offices: Bank of Toronto, Cor. Wellington & Church Sts.
58 Wellington St. East
Toronto

G. G. S. Lindsey, K.C.
Telephone Main 6070
Cable Address: "Lindsey," Toronto
Codes, Broomhall, McNeil's 1908
Commissioner for taking affidavits in British Columbia.
counsel with
Gregory & Gooderham, Barristers and Solicitors,
Canada Life Building,
Toronto

Phone Main 2311
Cable Address "Segsworth" Toronto
R. F. SEGSWORTH
Barrister, Solicitor, Notary, Etc.
JARVIS BUILDING
103 Bay Street - TORONTO

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

WANTED—DRAUGHTSMAN familiar with Mill Work. State Experience and Salary Wanted.
Moose Mountain, Limited, Sellwood, Ont.

Mine superintendent, foreman, surveyor and assayer, with fifteen years experience, open for engagement.
Address Box 5, Can. Mining Journal, Toronto.

TO INVESTORS
I want $1,500 to fit out a prospecting expedition to carry on exploration work in the new gold field. Parties putting up the money will be entitled to a claim.
Box "A". Canadian Mining Journal

The Canadian Mining Journal

WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....
Address .....
.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the Precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

Guide Books to excursions of the International Geological Congress.

1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

1173. Memoir 20. Gold fields of Nova Scotia, by W. Malcolm. Map not published.

QUEBEC

1186. Memoir No. 35. Reconnaissance along the National Transcontinental Railway in Southern Quebec, by John A. Dresser.

ONTARIO

1242. Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH WEST PROVINCES

1279. Memoir 25. Report on the clay and shale deposits of the Western Provinces, by Heinrich Ries and Joseph Keele.

1225. Memoir 30. The basins of Nelson and Churchill rivers, by William McInnes. Map not published.

BRITISH COLUMBIA

1188. Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.

YUKON AND NORTH WEST TERRITORIES

1228. Memoir No. 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

1277. Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

1162. Map 26A. Bathurst and vicinity, Gloucester County, New Brunswick. Topography.

1163. Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.

QUEBEC

1284. Map 95A. Broadback River, Mistassini territory, Quebec. Geology.

1300. Map 100A. Bell River, Quebec. Geology.

1301. Map 101A. St. Hilaire and Rougemont Mountains, Rouville and St. Hyacinthe Counties, Quebec. Geology.

ONTARIO

1199. Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTHWEST PROVINCES

1221. Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.

1285. Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.

1295. Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.

1307. Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

1241. Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.

1303. Map 104A. Thompson River valley, below Kamloops Lake, British Columbia. Geology.

1287. Map 105A. Cadwallader Creek mining area, Lillooet Mining Division, B.C. Geology.

1304. Map 106A. Groundhog coal field, British Columbia. Geology.

1296. Diagram showing the geology of Graham Island, Queen Charlottle Islands, British Columbia.

1298. Map 99A. Southern portion of Cranbrook map-area, East and West Kootenay, British Columbia. Geology.

YUKON and NORTH WEST TERRITORIES

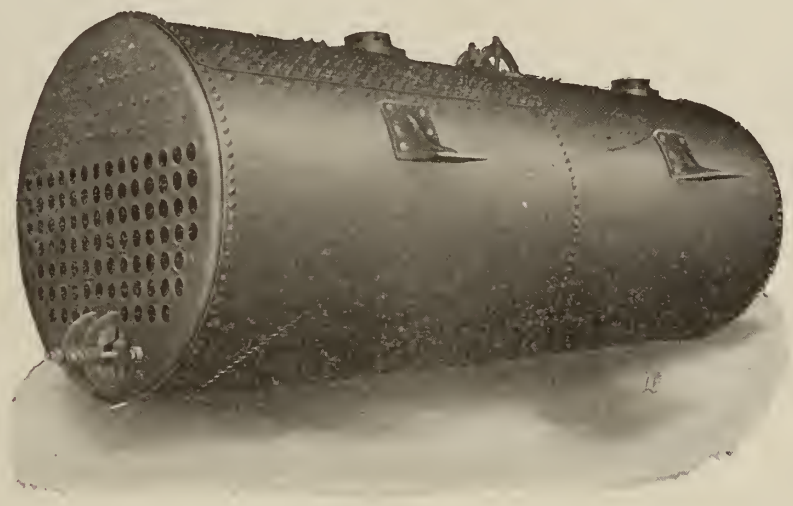
1332. Map 113A. Canadian routes to White River district, Yukon, and to Chisana district, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BOILERS



"INGLIS" STANDARD RETURN TUBULAR BOILER

We make Boilers of all kinds for any service.

For Fifty-two (52) years our boilers have been recognized as the Canadian Standard because they combine all the essentials requisite to produce the best boiler.

Is is a pleasure for us to show prospective buyers our different types of boilers in operation.

WRITE US FOR PRICES AND SPECIFICATIONS

The John Inglis Co.,
LIMITED

Engineers and Boilermakers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL, 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF . . . . . **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office: 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores
Manufacturers of
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

Balbach Smelting and Refining Co. Newark, N. J.

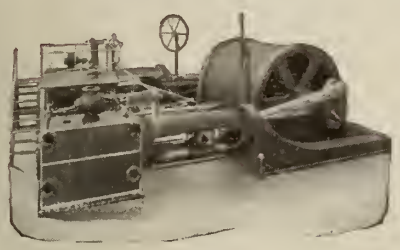
Buyers of
Gold, Silver, Lead and Copper Ores.
Lead Residues and Copper Residues.

Electrolytic Copper Refinery

INQUIRIES SOLICITED

HOISTING PROBLEMS

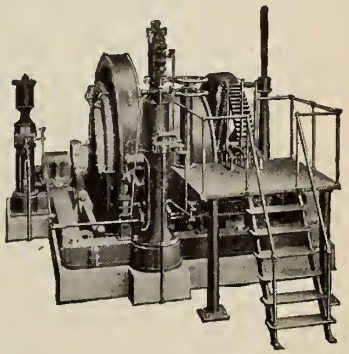
STEAM OR ELECTRIC



Duplex Corliss Hoist
See Bulletin 1803.

The best policy for any user of hoisting apparatus before determining upon the character of the equipment to be installed is to consult the records of the manufacturer who has studied and designed hoists for all conditions.

The greatest fund of information on hoisting problems is to be found in the records of Allis-Chalmers Manufacturing Company, which for the last half century has led in the development of hoisting as well as all types of power equipment :—Steam, Electrical, Air, Gas and Hydraulic.



Single Drum Electric Hoist
See Bulletin 1445

CANADIAN ALLIS-CHALMERS, LIMITED

HEAD OFFICE : TORONTO. DISTRICT SALES OFFICES : MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER, PRINCE RUPERT.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFER IOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will bematerially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co. 2
American Diamond Rock Drill Co. 16
Astley, J. W. 23

B

Balbach Smelting & Refining Co.. 28
Bartlett, C. O., & Snow Co. 17
Bath, Henry & Son 28
Beatty, Blackstock, Fasken, Cowan & Chadwick 24
Beatty, M. & Sons, Ltd. 11
Belleville Assay Office 25
Bennett, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons 16
Blackwell, Geo. G., Sons & Co. ... 28
British Columbia, Province of ... 18
Brown & Butters 23
Burchell, Geo. B. 23
A. M. Byers Co .....
.....inside front cover

C

Canadian Allis-Chalmers, Limited.. 29
Campbell & Deyell 25
Canadian Cleveland Drill Co 9
Canadian Copper Co. 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22
Canadian Laboratories, Ltd. 25
Canadian Northern Steamships ... 6
Canadian Ingersoll-Rand Co., Ltd... 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith 23
Cohen, S. W. 23
Colvocoresses, G. M. 23
Consolidated Mining & Smelting Co 28
Coniagas Reduction Co., Ltd. 28
Curtis's & Harvey .....
.....Outside back cover

D

Dept. of Mines, Canada 26
Deloro Mining & Reduction Co... 28
DePencier, H. P. 23
Diamond Drill Contracting Co..... 16
Dominion Coal Co., Ltd. 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co. 16
Donald, Dr. J. T. 25
Dorr, Jno. V. N. 24
Drury, H. A. Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Electric Steel & Metals Co., Ltd. .. 8
Evans, J. W. 23

F

Ferrier, W. F. 23
Fleck, Alex. 6
Flory, S., Mfg. Co. 12
Forbes, D. L. H. 23
Fowler, S. S. 23
Fraser & Chalmers of Can., Ltd.... 4
Federal Engineering Co., Ltd. 31

G

Goodyear Tire & Rubber Co. of Can. Ltd. 21
Graham, S. N. 23
Gray, John 25
Greening, B., Wire Co., Ltd. 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John 24
Hardman, J. E. 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd. 25
Heys, Thos. & Son 25
Hille, F. 24
Holman Drill Co. 20

I

Inglis, John & Co., Ltd. 27
Imperial Bank of Canada 11
Industrial & Technical Press, Ltd.. 13
International Nickel Co. 8

J

James Ore Concentrator Co. .....
.....Outside back cover
Jeffrey Manufacturing Co. 19
Jenckes Machine Co. 5
Johnson, W. S. 24
Jones & Glassco 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co. 25
Legg Brothers. 35
Loring, F. C. 24
Lymans, Limited 9
Lands of the Algoma Central and Hudson Bay Ry. 36
Lindsey, G. G. S. 24

M

Herbert Morris Crane & Hoist Co., Ltd. 16
Morton, B. K. & Co. 18
McEvoy, James 24
Mussens, Limited .....
.....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co. 10
Nova Scotia, Province of 15
Northern Canada Supply Co., Ltd. 6
Northern Electric Co. Ltd. 5

O

Orford Copper Co. 8
Ontario, Province of 30

P

Peacock Bros. 7
Pickings, H. B. 24
Pyke, James W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Stanley, W. F. & Co., Ltd. 12
Schaaf-Regelman, E. 28
Scott, G. S. 24
Segsworth, W. E. 24
Smart-Turner Machine Co. 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd. .....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Standard Underground Cable Co. of Can. Ltd. 15
Sullivan Machinery Co. 2
Summerhayes, Maurice W. 24
Swedish Steel & Importing Co., Ltd. 12

T

Geo. Taylor Hardware Co., Ltd.... 4
Tyrrell, J. B. 24

W

Walker Bros. 7
Waterous Engine Works Co. Ltd. .. 9

SCANDINAVIA BELTING — FEDERAL ENGINEERING & SUPPLIES LIMITED — TORONTO

Scandinavia Belting for direct drives and conveying. The conveyor belt is furnished in two dressings :

BROWN—for use where not exposed to extremely cold temperature. GREEN—for use where the Belt is used when the temperatures are very low.

Get our book on Belting Information. It is free.

FEDERAL ENGINEERING CO'Y. LTD.
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

THE ROESSLER & HASSLACHER CHEMICAL COMPANY — CHEMISTS — NEW YORK — 101 PARK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.
Jenckes Machine Co., Ltd.

Amalgamators—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd
Peacock Bros.
Geo. Taylor Hardware Co,Ltd

Bags—
Smart-Woods, Ltd.

Ball Mills—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Canadian Fairbanks-Morse
Federal Engineering Co.,
G. Taylor Hardware Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd
Curtis & Harvey (Canada), Limited.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Blowers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Boilers—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Waterous Engine Works Co.,
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
The John Inglis Co., Ltd.

Buckets—
Rock & Power Mach'y, Ltd.
Peacock Bros.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd

Cable — Aerial and Underground—
G. Taylor Hardware Co., Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Jenckes Machine Co., Ltd.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.
G. Taylor Hardware Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Cement Machinery—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Krupp, Fried. A. G., Germany
Jenckes Machine Co., Ltd.
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Chain Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell
Thos. Heys & Son
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Handling Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Compressors—Air—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd
Laurie & Lamb
Canadian Westinghouse
Can. Ingersoll-Rand Co. Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Canadian Fairbanks-Morse
Jenckes Machine Co., Ltd.

Concrete Mixers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Condensers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.,
Peacock Bros.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Waterous Engine Works

Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith
B. Greening Wire Co., Ltd.
G. Taylor Hardware Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Lymans, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Jenckes Machine Co., Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roessler & Hasslacher
Thos. & Wm. Smith
Peacock Bros.

Derricks—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Drills—Core—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Can. Ingersoll-Rand Co., Ltd

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Elevators—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Peacock Bros.

Engineering Instruments—
C. L. Berger & Sons
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Mussens, Ltd.
Alex. Fleck
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
M. Beatty & Sons
Canadian Westinghouse
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Engines—Oil—
Rock & Power Mach'y, Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.

Engines—Steam—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons
Laurie & Lamb
Mussens, Ltd.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Filters—
Krupp, Fried, A. G., Germany

Friction Hoists—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.

Forgings—
M. Beatty & Sons
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Bros.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA :	Halifax
QUEBEC :	Montreal
ONTARIO : Toronto, Cobalt, South Porcupine, Port Arthur,	Kingston
MANITOBA :	Winnipeg
ALBERTA :	Edmonton
BRITISH COLUMBIA : Vancouver, Victoria, Nelson,	Prince Rupert

Distributing magazines at all district office points, also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C. Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krup, Fried. A. G., Germany
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey, (Canada), Limited
Canadian Westinghouse
Canadian Explosives
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Gears—
Canadian Westinghouse
Krupp, Fried. A G., Germany
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse
Northern Electric Co., Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Heaters—Feed Water—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Laurie & Lamb
Canadian Westinghouse
Peacock Bros.
Fraser & Chalmers, Ltd.
G. Taylor Hardware Co., Ltd.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air Electric and Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
S. Flory Mfg. Co.
Jones & Glassco
Waterous Engine Works
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
Rock & Power Mach'y, Ltd.
Jenckes Machine Co., Ltd.

Hoisting Engines—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Cleveland Drill Co.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Jacks—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives
Peacock Bros.
Ackroyd & Best
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works
Northern Canada Supply Co.
Jones & Glassco

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.
Canadian Westinghouse
Siemens Co. of Canada, Ltd.

Locomotives—Steam—
Mussens, Ltd.
Canadian Westinghouse

Metal Merchants—
Henry Bath & Son
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Northern Electric Co., Ltd.
Can. Fairbanks-Morse Co.
G. Taylor Hardware Co., Ltd.
Canadian Westinghouse
Peacock Bros.
Siemens Co. of Canada, Ltd.

Ore Sacks—
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Ore Testing Works—
Ledoux & Co.
Can. Laboratories
Milton Hersey Co., Ltd.
Campbell & Deyell

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada
Krupp, Fried, A. G., Germany
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Thos. & Wm. Smith
Peacock Bros.

Pipes—
Consolidated M. & S. Co.
Peacock Bros.
G. Taylor Hardware Co., Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Canadian Westinghouse
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
G. Taylor Hardware Co., Ltd.
Jones & Glassco

Producer—Gas—
Krupp, Fried, A. G., Germany
Mussens, Ltd.

Prospecting Mills and Machinery—
Rock & Power Mach'y, Ltd.
Standard Diamond Drill Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
G. Taylor Hardware Co., Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Laurie & Lamb
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Rock & Power Mach'y, Ltd.
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Jeffrey Mfg. Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumatic—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Can. Ingersoll Rand Co., Ltd.

Pumps—Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co. Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
G. Taylor Hardware Co., Ltd.
The John Inglis Co., Ltd.

Pumps—Turbine—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Can. Cleveland Drill Co.
Krupp, Fried. A. G., Germany
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany

Rolls—Crushing—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Can. Allis-Chalmers, Ltd.

Roofing—
Paterson Mfg. Co.
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville
Geo. Taylor Hardware Co,Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.
G. Taylor Hardware Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany
Thos. Heys & Son

Screens—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
R. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.
Jenckes Machine Co., Ltd.

Separators—
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
M. Beatty & Sons

Slime Tables—
Deister Concentrator Co.
James Ore Concentrator
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Smelting Machinery—
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.

Stamp Mills—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drills—
Rock & Power Mach'y, Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A G., Germany
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd
G. Taylor Hardware Co., Ltd.

Steel—Tool—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley
C. L. Berger

Switchboards—
Canadian Westinghouse
Can. Allis-Chalmers, Ltd.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Tanks—Cyanide, Etc.—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.
Jenckes Machine Co., Ltd.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.

Transformers—
Canadian Westinghouse
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Peacock Bros.
Siemens Co. of Canada, Ltd.

Transits—
C. L. Berger & Sons
W. F. Stanley
Peacock Bros.

Tractors—Oil—
Can. Fairbanks-Morse Co.

Tube Mills—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.

Turbines—
Rock & Power Mach'y, Ltd.
Canadian Westinghouse
Peacock Bros.
Laurie & Lamb
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Winding Engines—
Rock & Power Mach'y, Ltd.
Waterous Engine Works
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Wire Cloth—
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co.

Wire (Bare and Insulated)—
Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.

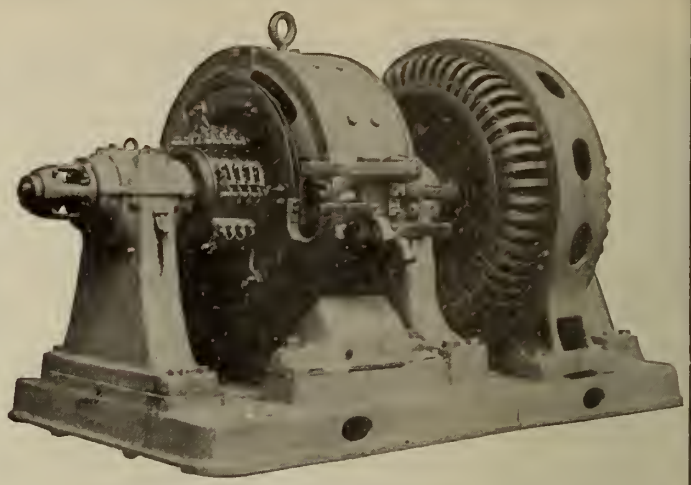
Zinc Dust—
Roessler & Hasslacher.

LEGG BROS
ENGRAVING CO.
DESIGNING ENGRAVING
5 JORDAN ST
TORONTO CANADA

The thoroughly successful performance in mine sub-stations of

Westinghouse Motor Generator Sets

is due to the fact that they were designed only after a careful study of power requirements in mines; and long experience in the application of electrical apparatus.



Westinghouse 100 KW, Self-Starting, Synchronous Motor Generator Set

Some of their advantages are:

Sparkless commutation over a wide range of load and overload.
High efficiency at all loads, particularly on fractional loads.
Simplicity combined with strength.
High power factor at all loads.
Minimum attention required.

These are a few of the many excellent features embodied in the design of Westinghouse Motor Generator Sets for mine sub-stations.

Our nearest office will furnish further information promptly upon request.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO Traders Bank Bldg. | MONTREAL 52 Victoria Sq. | OTTAWA Ahern & Soper, Ltd. | HALIFAX Telephone Bldg. | WINNIPEG 158 Portage Ave. E. | CALGARY Grain Exchange Bldg. | VANCOUVER Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

—— FOR REGULATIONS, MAPS, ETC., APPLY TO ——

JOHN A. DRESSER,
Manager, Lands Dept., A. C. & H. B. Ry.,
Sault Ste. Marie, Canada

THE
JOURNAL OF COMMERCE
With which is incorporated THE SHAREHOLDER, edited by J. C. Ross, M. A.

May be had at any bookstall, **5c. the copy,** and should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

—— Published by ——
THE INDUSTRIAL & EDUCATIONAL PRESS, Limited
35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto
—— which also publishes ——
CANADIAN MINING JOURNAL *Editor: Reginald E. Hore, B.A.*
CANADIAN TEXTILE JOURNAL *Editor: E. Stanley Bates*
PULP AND PAPER MAGAZINE OF CANADA *Editor: A. Gordon McIntyre, B.A., B.Sc.*
CANADIAN MILLER AND CEREALIST *Editor: J. G. Adams, B.A.*
CANADIAN FISHERMAN *Editor; F. Wm. Wallace*
These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

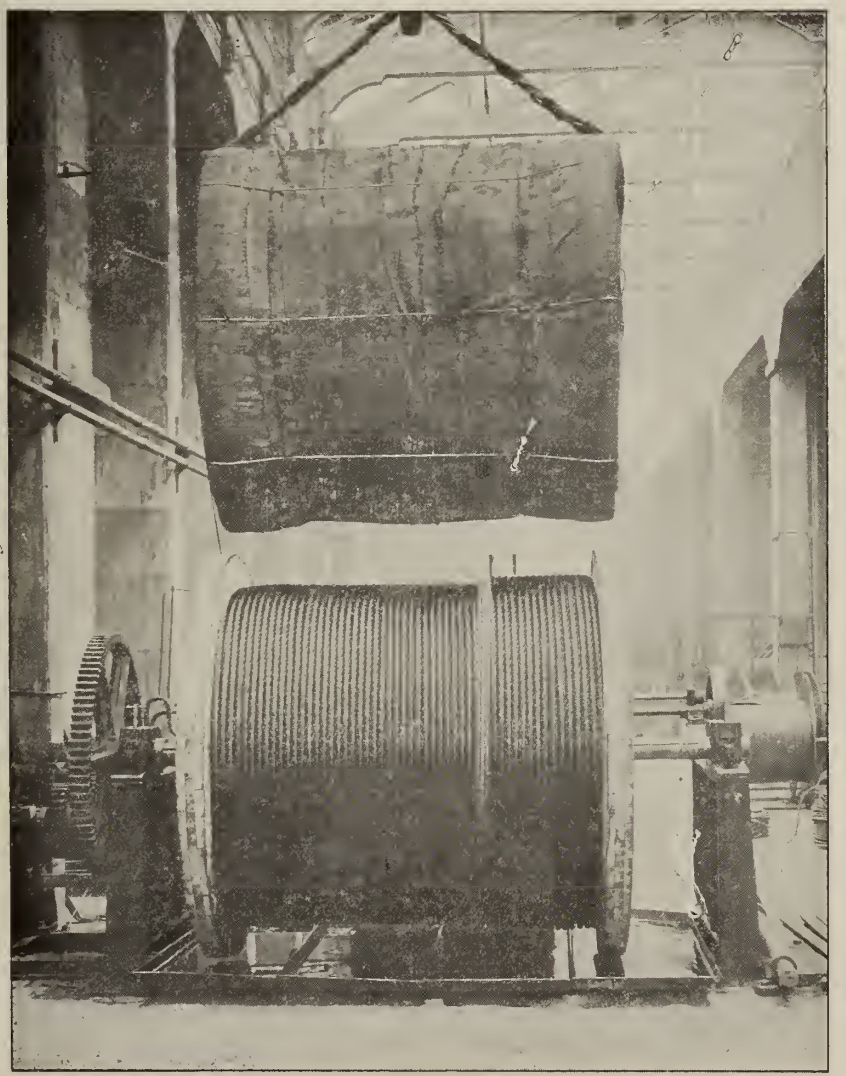
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each

MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.

The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

IF

You are Not Already Using

CURTISS & HARVEY (CANADA) LIMITED
D·C·A
DRAGON BRAND

Explosives

Write to

MONTREAL

400 St. James St.

JUNE 15, 1914 Single Copies 15 Cents

CANADIAN MINING JOURNAL

VOL. XXXV TORONTO No. 12

FOR SINKING AND DRIFTING

The Hardy Simplex

AUTO ROTATOR

IS

THE DRILL

It is small but does BIG WORK

TRY IT

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
VANCOUVER 101 Water St.
COBALT, Opp. Right of Way Mine
QUEBEC 31 St. Louis St.
WINNIPEG, 259-261 Stanley St.
HALIFAX 78 Granville St.
CALGARY, 10th Ave. and 3rd St. E.

Hand Puddled
— in small heats

The Dreaded Pipe Destroyers — Corrosion and Electrolysis
The Greatest Factor in Pipe Cost — Constant Repairs
The Frequent Cause of Pipe Failure — Flaws

These — and many other pipe problems — overcome by

BYERS GENUINE WROUGHT IRON PIPE
FULL WEIGHT GUARANTEED

BYERS Pipe offers greatest resistance to the attacks of corrosive agents, and to the disintegrating action of electrolysis. It possesses the highest known factor of safety in these important phases of pipe service.

Byers Pipe gives uniform, dependable, continuous service. It is remarkable for its freedom from sudden failures, and for its ability to meet the most excessive demands of emergency. This reliability is due to its absolute genuineness, full weight, and the absence of flaws. Byers Pipe is made from the best grade of pig iron, by careful, hand-controlled processes. It is tough, fibrous, ductile — capable of withstanding great torsional, tensile and pressure stresses, incessant vibration, and the fracture forces exerted by sudden changes of temperature.

Byers Pipe represents the highest degree of pipe economy. Its lasting, low-cost service is in marked contrast with the expensive repairs and replacements that must constantly be made on inferior pipe installations.

These qualities of Byers Pipe have been completely demonstrated by actual service. They have been proved real—not merely theoretical—by the continuously recorded experience of fifty years.

The year 1914 marks the Fiftieth Anniversary of Byers. Since 1864 the Byers reputation for careful, hand-controlled methods, highest quality of material, and manufacturing independence has been consistently maintained.

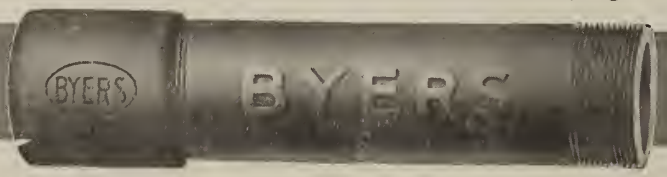
Send for the Byers Book—"The Control of Quality in Every Process." It contains valuable information for every pipe user.

A·M·BYERS COMPANY
ESTABLISHED 1864
PITTSBURGH, PA.

DISTRICT AGENTS AT

New York City	Boston	Philadelphia
Chicago	Dunkirk	Buffalo
Cleveland	Toledo	Cincinnati
Detroit	Kansas City	Denver
Milwaukee	San Francisco	Los Angeles
Portland, Ore.		

Look for the Byers Mark on every length of coupling



HOLLOW
ROCK DRILL STEEL

SOLID
ROCK DRILL STEEL

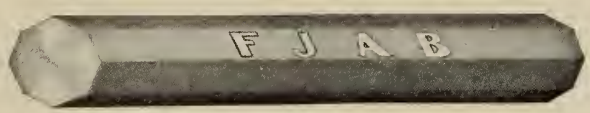
All sizes and shapes

HEXAGON, OCTAGON, QUARTER-OCTAGON, ROUND and CRUCIFORM.

Quality, Uniformity, Reliability, Economy

ONCE ADOPTED, ALWAYS USED

IT WILL PAY YOU TO USE



TOOL STEEL FOR ALL CLASSES OF TOOLS

Send for a Trial Order

SOLD IN CANADA BY

Rock & Power Machinery

Limited

HEAD OFFICE: 12 King Street East, Toronto, Ont.

BRANCH OFFICES:

VANCOUVER; MONTREAL; HALIFAX; COBALT; SUDBURY;
AND IN THE KING EDWARD HOTEL, TORONTO

CONTRACTORS TO ADMIRALTY WAR OFFICE AND COLONIAL GOVERNMENTS

Allan, Whyte & Co.

CLYDE PATENT WIRE ROPE WORKS,

Rutherglen, Glasgow, Scotland

WIRE ROPES

For Mining, Engineering and Shipping: For Hoisting and Haulage in Collieries and Mines: For Cableways and Aerial Ropeways: For Dredgers and Steam Shovels: Specially Flexible Ropes for Winches and Fast Hoists, Coal Towers and Cranes.

OF THE HIGHEST QUALITY

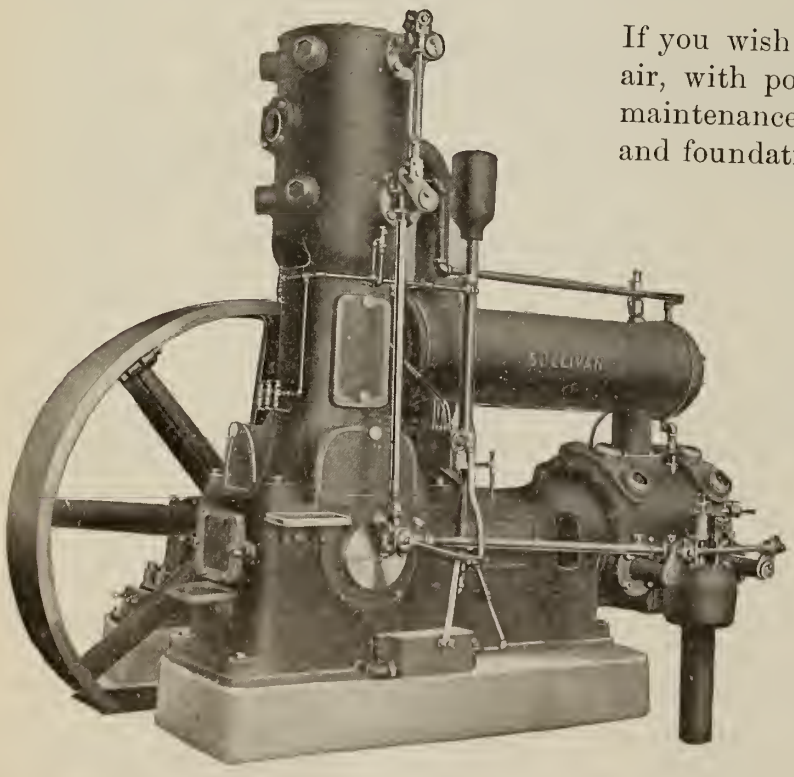
made from special grades of Wire drawn to our specifications and carefully tested before being used. They are at work in all parts of Canada from Vancouver to Halifax and are everywhere recognised as the best on the market. Complete stocks held in all parts. Orders executed and quotations furnished by:--

Nova Scotia: Wm. Stairs, Son & Morrow, Ltd., Halifax. New Brunswick: W. H. Thorne & Co., Ltd., St. John.
Quebec, Ontario, Manitoba and Saskatchewan: Drummond McCall & Co., Montreal, Toronto and Winnipeg.
Alberta and British Columbia: McLennan, McFeely & Co., Ltd., Vancouver.

Highest Quality. Satisfaction in Use. Prompt Delivery. Keen Prices.

CABLES: "Ropery, Rutherglen." CODES: Western Union, A. B. C. (4th and 5th Editions), A.1., Liebers and Private.

Your Next Air Compressor?



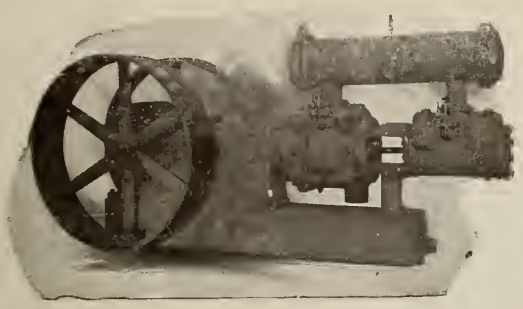
If you wish to get the most actual compressed air, with power drive, at least cost for power, maintenance, care and attention, floor space and foundations, investigate

Sullivan Angle-Compound Compressors

In these "W J 3" machines, reciprocating forces are balanced, the drive is very adaptable, floor space and foundations are small, the working parts are few and the compressor is practically automatic.

Capacity, 400 to 1100 cu. ft.
Send for Bulletin 658-S.

Sullivan Machinery Co.
122 So. Michigan Ave., Chicago, U.S.A.
Montreal, Cobalt, Nelson, Vancouver



INDIVIDUALITY

WOULD it not be well to acquaint yourself with the individuality of the air compressor you are going to buy before making a definite selection?

You would naturally do this when selecting a person for a responsible position. Is it not just as important when selecting a machine for an equally responsible position?

When you consider that often both the quality and quantity of your output depend largely, if not almost wholly, on your compressor, you must realize that it should possess a marked individuality and unfailing reliability.

The experience of nearly half a century in building compressors for every conceivable purpose; the refinement resulting from this wide and varied experience; the development in the use of special metals and treatment thereof are reflected in the individuality of Ingersoll-Rand Compressors.

The correct proportioning of ports and passages; the use of superior valves; the reduction of losses through slippage of air past valves and other moving parts; the use of adequate and proper cooling systems: the correct proportioning of cylinders to properly distribute the work done and the careful workmanship characterizing important parts of Ingersoll-Rand Compressors, all guarantee the maximum delivery of compressed air with the minimum of power.

Then, too, the selection and use of special alloy metals, strengthened, toughened and hardened by elaborate processes to increase life and wear; the liberal proportioning of bearings; the enclosed dust-proof automatic flood oiling systems and many other related features, minimize wear, repairs and upkeep costs. They increase the value of Ingersoll-Rand Compressors to their users and give them the rating of air compressor aristocracy.

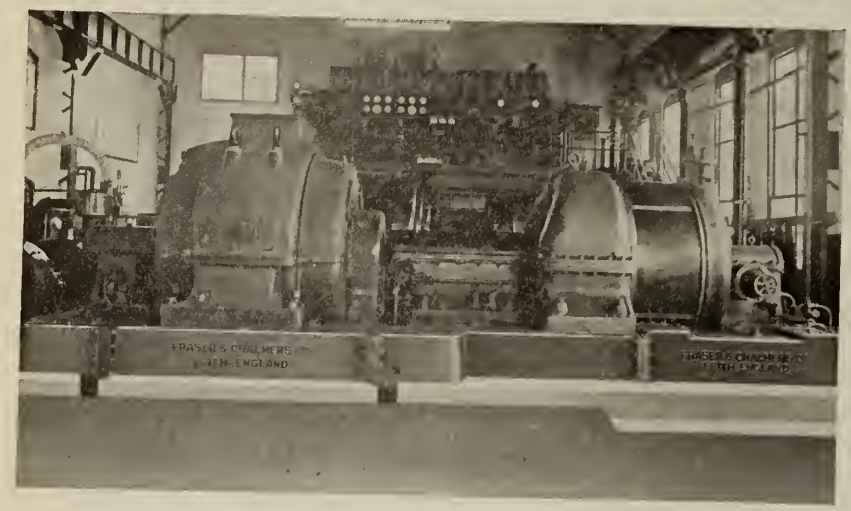
Efficient, reliable. self-control devices are of a distinctly superior character in Ingersoll-Rand machines and automatically proportion work done to compressed air requirements. Here, too, the individuality of Ingersoll-Rand compressors stands out and minimizes the element of attendance.

CANADIAN INGERSOLL-RAND CO.
LIMITED

COMMERCIAL UNION BUILDING, MONTREAL, CAN.
WORKS: SHERBROOKE, QUE.

SYDNEY MONTREAL TORONTO COBALT SOUTH PORCUPINE WINNIPEG LETHBRIDGE NELSON VANCOUVER

Fraser & Chalmers Steam Turbines



A 3000 K.W. Unit recently installed by The Dominion Coal Company, Limited, Glace Bay, N.S

RATEAU TYPE

We specialize in turbo-compressors, turbo-blowers, turbo-pumps and fans of the above type. Over 10,000 H.P. of F. & C. turbines have been ordered for installation in Canada.

FRASER & CHALMERS OF CANADA, LIMITED

4 Phillips Place - MONTREAL

Assay and Chemical Supplies

Morgan Battersea Clay Goods, Jena Glassware, Royal Berlin Porcelain Ware, Munktell's, Pratt Dumas and Schleicher & Schull's Filter Papers. Screens all sizes. Riffles, Samplers all kinds. Ainsworth Balances, etc.
Large stock of Fluxes always on hand.
A full line of Keuffel & Esser's drawing and drafting material carried in stock.
Brunton Transits.

Corona Drill Steel, Cruciform and Octagon
Corona Tool Steel—Rounds—Squares—Flats
Bar Iron, Steel Shafting, Pipe, Steel Plates and Sheets.
Angles

Carried in Stock.

Special Shapes and Sizes to Order

Get our prices before you place your order

THE GEORGE TAYLOR HARDWARE, LIMITED

NEW LISKEARD (Head Office) COBALT COCHRANE

A New Book By a Mining Engineer

Published April, 1914

Compressed Air

Production—Transmission—Use

By THEODORE SIMONS, E.M., C.E.

Professor of Mining Engineering, Montana State School of Mines; Member American Institute of Mining Engineers.

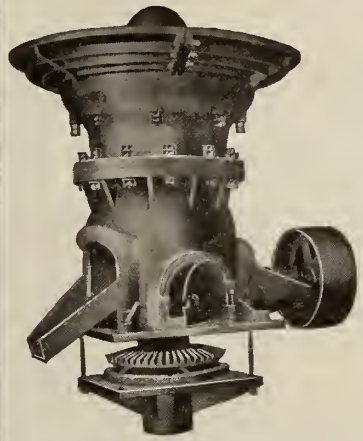
173 pages, 6x9, fully illustrated. *$1.50 (6/3) net, postpaid.*

The author's aim has been to give such insight into the natural laws and physical principles underlying the production, transmission and use of compressed air, as shall enable the reader to comprehend the operation of various appliances and judge of their merit.

He does not attempt to give extensive descriptions of existing types of compressors, but only examples which illustrate the principles, and which enable the student and investigator to solve the theoretical problems arising in the use of compressed air.

—— *For Sale By* ——

Canadian Mining Journal, - Toronto, Canada



Gyratory Crushers

MADE IN CANADA

Combining the Standard Features of this type of Crusher, and also our

Water Cooled Eccentric Bearing

Made in all sizes for all capacities and for crushing any kind of material.

We are building a full line of crushing, mining, cement making, hoisting and power machinery. Air Compressors and Rock Drills.

Write for Full Particulars

The Jenckes Machine Co., Limited

MAIN OFFICE and WORKS: SHERBROOKE, QUE

DISTRICT OFFICES:

St. Catherines, Toronto, Montreal, Cobalt, South Porcupine, Vancouver and Nelson

Synopsis of Coal Mining Regulations

COAL mining rights of the Dominion, in Manitoba, Saskatchewan and Alberta, the Yukon Territory, the North-West Territories and in a portion of the Province of British Columbia, may be leased for a term of twenty-one years at an annual rental of $1 an acre. Not more than 2,560 acres will be leased to one applicant.

Application for a lease must be made by the applicant in person to the Agent or Sub-Agent of the district in which the rights applied for are situated.

In surveyed territory the land must be described by sections, or legal sub-divisions of sections, and in unsurveyed territory the tract applied for shall be staked out by the applicant himself.

Each application must be accompanied by a fee of $5 which will be refunded if the rights applied for are not available, but not otherwise. A royalty shall be paid on the merchantable output of the mine at the rate of five cents per ton.

The person operating the mine shall furnish the Agent with sworn returns accounting for the full quantity of merchantable coal mined and pay the royalty thereon. If the coal mining rights are not being operated, such returns should be furnished at least once a year.

The lease will include the coal mining rights only, but the lessee may be permitted to purchase whatever available surface rights may be considered necessary for the working of the mine at the rate of $10.00 an acre.

For full information application should be made to the Secretary of the Department of the Interior, Ottawa, or to any Agent or Sub-Agent of Dominion Lands.

W. W. CORY, Deputy Minister of the Interior.

N.B.—Unauthorized publication of this advertisement will not be paid for.—58782.

Canadian Northern "Atlantic Royals"
TO EUROPE

Thermo Tank Ventilation.

Triple Screw Turbine.

Montreal to Bristol
"Central Port of England."

R.M.S.
"Royal Edward"

R.M.S.
"Royal George"

These Steamers are equipped with the latest devices for the safety, comfort and convenience of passengers. Marconi Wireless, deep sea telephone, passenger elevators. Every room is ventilated by the thermo tank system, which warms or cools the fresh sea air and distributes it over the entire ship every five minutes. The private suites of apartments and the luxuriously appointed public cabins, treated after historic periods in decorative art, are unexcelled by anything on the Atlantic.

For Seaworthiness Unequalled. **Fastest Boats in the British-Canadian Service.**

For all information apply to Steamship Agents, or to the following General Agents of the Company:—

123 Hollis Street, Halifax, N.S. 226-30 St. James St., Montreal, Que. 583 Main Street, Winnipeg, Man. 52 King St. E., Toronto, Ont.

"NOTICE TO ALL MINING COMPANIES"

We are in a position to supply you with your requirements in all lines of Machinery and Supplies.

Sullivan Diamond Drills, Compressors, Rock and Hammer Drills, Hoists, Boilers, Ore Cars, Buckets, Drill Steel, Drill Sharpeners, Shafting, Transmission and Conveying Material.

Hoisting Cable, Screens, Iron Pipe and Fittings, Valves, Building Supplies, Camp and Kitchen Supplies, General Line Light and Heavy Hardware.

We will be pleased to have your specifications and to quote you on your requirements.

"IT WILL PAY YOU TO GET OUR PRICES."

Our Large Stock Guarantees You the Most Prompt Delivery on All Orders.

NORTHERN CANADA SUPPLY CO.
LIMITED
COBALT PORCUPINE TIMMINS

Milling and Mining Machinery

Shafting, Pulleys, Gearing, Hangers, Boilers, Engines, and Steam Pumps, Chilled Car Wheels and Car Castings, Brass and Iron Castings of every description, Light and Heavy Forgings.

Alex. Fleck, Ltd. - Ottawa

Michigan College of Mines

A state institution offering engineering eourses leading to the degree of Engineer of Mines. Loeated in the Lake Superior mining distriet. Mines and mills accessible for college work. For Year Book and booklet of views, address President or Secretary.

HOUGHTON **MICHIGAN**

HADFIELDS

LIMITED

SHEFFIELD

STEEL CASTINGS

of Every Description

Send for Bulletin No. 79

SOLE MAKERS OF HADFIELD'S PATENT

"ERA" MANGANESE STEEL

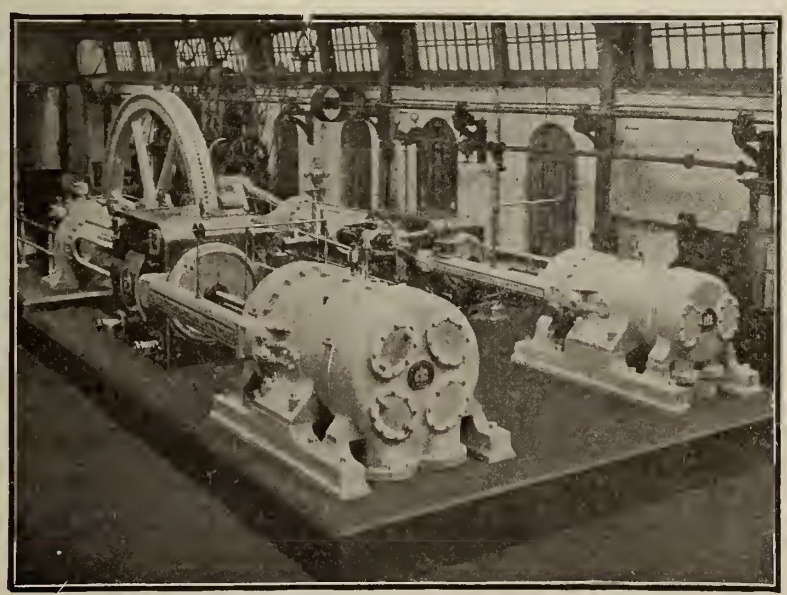
THE SUPREME METAL FOR WEARING PARTS

SOLE AGENTS

Montreal **PEACOCK BROTHERS** Vancouver

WALKER BROTHERS (WIGAN)

LIMITED



Horizontal Compound Corliss Steam Two-Stage Air Compressing Engines with Air Valves to Walker's Latest Patents.

AIR COMPRESSING ENGINES

With Valves to Recent Patents

THE

"WALKER" COMPRESSOR

is deservedly famed for

Service, Reliability, Efficiency, Economy and Low Upkeep.

Dominion Coal Company

Limited

Glace Bay — Nova Scotia

19 Collieries
Output—5,000,000 tons annually

"Dominion" Coal
Screened, run of mine and slack

"Springhill" Coal
Screened, run of mine and slack

Collieries at Glace Bay, C.B., and Springhill, N.S.

Shipping Ports—Sydney and Louisburg, C.B., and Parrsboro, N.S.

For Prices and Terms Apply to:

Alexander Dick, General Sales Agent,
112 St. James Street, Montreal
or at the offices of the Company at
171 Lower Water Street, Halifax, N.S.
and to the following Agents
R. P. & W. F. Starr, St. John, N.B.
Buntain, Bell & Co., Charlottetown, P.E.I.
Hull, Blyth & Co., 1 Lloyds Ave., London, E.C.
Harvey & Co., St. John's, Nfld.

FOR SALE

Steam Hoisting Engines and Pumps

The following machinery has been put out of service by an electric installation and is offered for immediate delivery, f.o.b. cars Stellarton, Nova Scotia.

1 Novelty Iron Works Steam Hoisting Engine. Duplex cylinders, 16″ diameter by 42″ stroke. Geared to 2 cast iron drums 9′ diameter by 56″ wide. Gear ratio 3 to 1, also 6,500′ of 1″ steel cable.

1 I. Matheson and Company's Steam Hoisting Engine, duplex cylinders, 16″ diameter by 30″ stroke. Geared to 2 cast iron drums 9′ diameter by 54″ wide. Gear ratio 2.4 to 1.

1 Jeansville Duplex Triple Expansion Pumping Engine, Steam cylinders 19″, 27″ and 44″ diameter, by 36″ stroke. Water cylinder 9″ diameter, together with jet condenser and condenser pump. Outfit capable of handling 1,000 gallons per minute against 1,800 feet head. Very low prices.

Address

Acadia Coal Company, Limited,
Stellarton, N.S.

ELECTRIC STEEL CASTINGS

Our Welland Plant will be ready to furnish Carbon, Manganese, Alloy Steel Castings and Forging Ingots by the end of May, made by the Electric Furnace Process. This process makes a dependable high-grade Steel and Steel Castings, a tough homogeneous material, free from blow-holes, and having a remarkable resistance to fatigue.

Write us for prices and particulars.

THE ELECTRIC STEEL & METALS CO., LIMITED
WELLAND - ONTARIO

Shot

Blocks

Ingots

METALLIC NICKEL

Prime Metal for the manufacture of Nickel Steel, German Silver, Anodes and all Alloy purposes.

The International Nickel Co.

43 Exchange Place — New York

ALSO

Electrolytic Nickel

(99.80% Pure)

Different

kinds of work require different tools —we make a specialty of

Stope Drills

only, and know that our continuous efforts to produce the most efficient and most economical Stope Drill on the market have met with wonderful success.

The "Cleveland"

receives universal praise wherever it is seen or tried. Can we send you an equipment for 30 days' trial?

Fully described in Bulletin No. 30

Cleveland Pneumatic Tool Co.
OF CANADA, LIMITED
Successors to
The Canadian Cleveland Drill Co.
Limited
80 Duchess Street, TORONTO

LYMANS, Limited

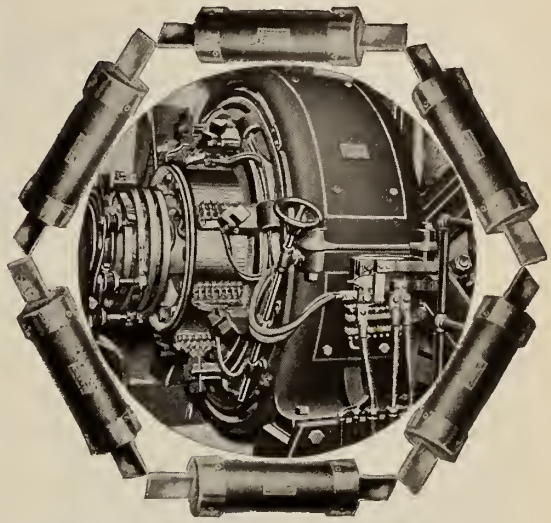
MONTREAL

adquarters for—

Balances
Crucibles
Crushers
Furnaces
Bone Ash
Borax
C.P. Acids and Chemicals
Etc., Etc.

Assay Supplies
Largest Stock in Canada

Assay Supplies
Largest Stock in Canada



PROTECTED!

The safety of your electrical equipment depends on the fuse.

A fuse that fails to blow at the right moment may cause the burning-out of costly motors and other devices—or even the destruction of your entire plant by fire.

Guard against the possibility of such a catastrophe by using

"NOARK" Enclosed Fuses

These fuses never fail to blow at the proper time and under the exact conditions claimed. Therefore they afford absolute protection at all times.

"Noark" Fuses operate with "no arc" or flash. They are practically noiseless.

And they are the most economical fuse on the market—

FIRST—because they require less frequent replacement—and

SECOND—because they can be refilled at a saving of 45%.

As they are made to N. E. C. Standard, they are interchangeable and approved by the Underwriters' Laboratories, Inc.

Write our nearest Branch for Booklet.

The Canadian H. W. Johns-Manville Co., Limited

Manufacturers of Asbestos Packings; Pipe Coverings; High Temperature Cements; Boiler Preservative; Conduit; Metallic Hose; Boiler Plugs; Stack Lining; Tube Cleaners; etc.

Toronto
Montreal

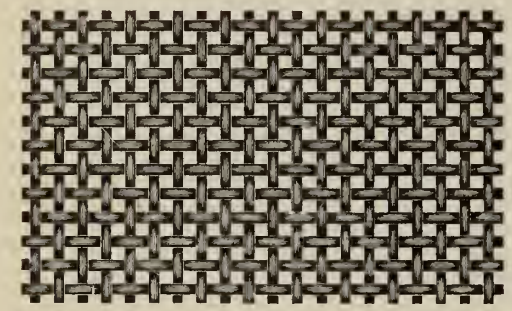
JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

Winnipeg
Vancouver

2202

GREENING'S

WIRE CLOTH - WIRE SCREENING



ALL GRADES OF WIRE CLOTH
DOUBLE CRIMPED

Screening Accuracy guaranteed.

Made of Steel, Copper or Brass.

Galvanized and Tinned Cloth.

PERFORATED METALS WIRE ROPE

The B. GREENING WIRE CO., Ltd.

HAMILTON, ONT. MONTREAL, QUE.

Nova Scotia Steel and Coal Co., Limited

Proprietors, Miners and Shippers of SYDNEY MINES BITUMINOUS COAL. Unexcelled Fuel for Steamships and Locomotives, Manufactories, Rolling Mills, Forges, Glass Works, Brick and Lime Burning, Coke, Gas Works, and for the Manufacture of Steel, Iron, Etc. COLLIERIES AT SYDNEY MINES, CAPE BRETON.

Manufacturers of Hammered and Rolled Steel for Mining Purposes

Pit Rails, T Rails, Edge Rails, Fish Plates, Bevelled Steel Screen Bars, Forged Steel Stamper Shoes and Dies, Blued Machinery Steel 3 8" to 14" Diameter, Steel Tub. Axles Cut to Length, Crow Bar Steel, Wedge Steel, Hammer Steel, Pick Steel, Draw Bar Steel, Forging of all kinds, Bright Compressed Shafting 5 8" to 5" true to 2/1000 part of one inch. A full stock of Mild Flat, Rivet Round and Angle Steels always on hand.

SPECIAL ATTENTION PAID TO MINERS' REQUIREMENTS. CORRESPONDENCE SOLICITED.

Steel Works and Head Office: NEW GLASGOW, NOVA SCOTIA

NOTICE

Anyone wishing bound copies of Canadian Mining Journal for 1913 should send in order at once. Price $4.00 for the 24 issues, bound in leather.

CANADIAN MINING JOURNAL

44-46 Lombard St., Toronto

Imperial Bank
of Canada
Established 1875

HEAD OFFICE: TORONTO

Capital Paid Up	$7,000,000
Reserve Fund	7,000,000

Branches in Northern Ontario at

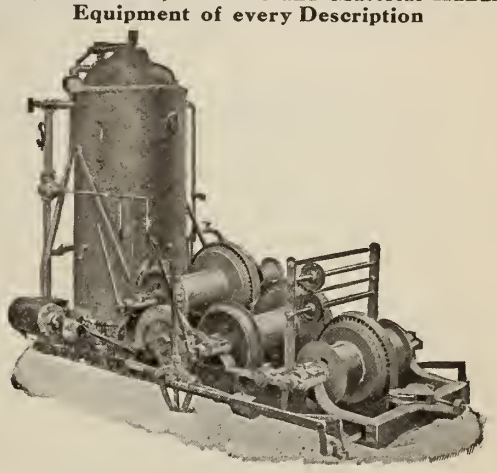
Cobalt, South Porcupine, Elk Lake, Cochrane, New Liskeard, North Bay and Timmins.

Branches in Provinces of

Ontario, Quebec, Manitoba, Saskatchewan, Alberta and British Columbia.

Money Transfers made to all parts of the World. Travellers' Letters of Credit, Drafts, Cheques, etc., negotiated.

BEATTY
Hoists, Clamshells, Derricks and Material Handling Equipment of every Description



Standard Two-Drum Hoist with Swinger.

Engines for every kind of hoisting duty.

BEATTY PLANT
on your work means uninterrupted service and complete satisfaction.

SEND FOR CATALOGUE, TO-DAY!

M. BEATTY & SONS, Limited
Welland - Ontario

AGENTS: H. E. Plant, 1790 St. James St., Montreal. H. W. Petrie, Ltd., Toronto. Rob't. Hamilton & Co., Vancouver, B.C. E. Leonard & Sons, St. John, N.B. A. R. Williams Machinery Co., Winnipeg.

'Tis too much proved,—
That with Devotion's visage
And pious action
We do sugar o'er the Devil himself.—"Hamlet"

The Devil Might be made to appear alright on the surface, but would still be the Devil, and pious action or visage could'nt change the fact, nor could he stand the test of time.

HARRIS HEAVY PRESSURE
"The Babbitt Metal Without a Fault"

HAS STOOD THE TEST OF TIME

H.H.P. is built for service
H.H.P. will run cool at any speed
H.H.P. will not crack or squeeze out.
H.H.P. is the best for all general bearings
H.H.P. is copper coated and copper hardened

Ask for prices. We are the Largest Exclusive Metal Men in Canada

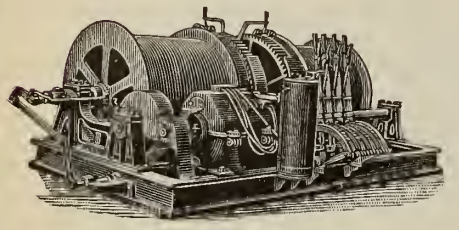
THE CANADA METAL COMPANY, LIMITED
HEAD OFFICE TORONTO
BRANCH FACTORIES Winnipeg, Montreal

Flory Hoisting Engines

STEAM AND ELECTRIC

Especially designed for Mines, Quarries and Contractor's work, such as Pile Driving, Bridge Building, and general Construction work.

The Flory Cableway System is superior to any on the market.

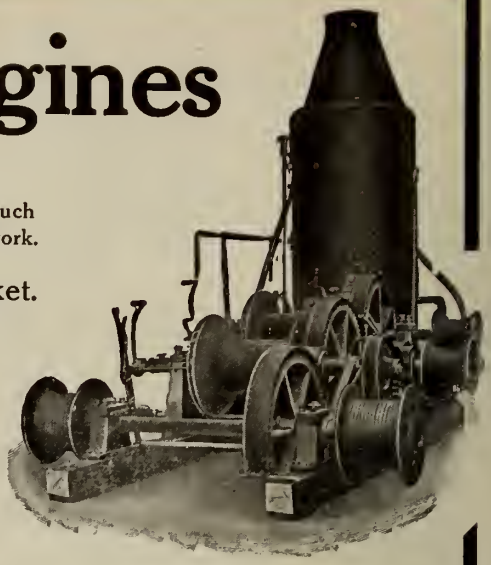


Slate Mining and Working Machinery.

SALES AGENTS:

J. MATHESON & CO.
New Glasgow, Nova Scotia

MUSSENS LIMITED
Montreal, Que.



S. Flory Mfg. Co.

ASK FOR OUR CATALOGUES

Office and Works: BANGOR, Pa., U.S.A.

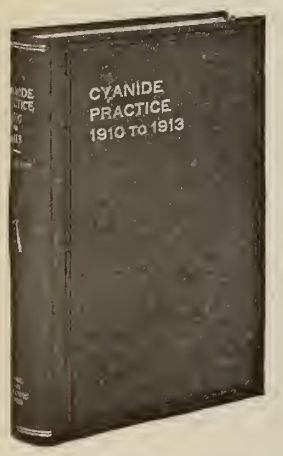
SISCO DRILL STEEL

Where other steel will not stand up, *WE GUARANTEE SATISFACTION*

AGENTS FOR COBALT AND PORCUPINE
Northern Canada Supply Co., Ltd.

SWEDISH STEEL & IMPORTING CO. LIMITED
MONTREAL

CYANIDE PRACTICE
1910-1913



Edited by

M. W. von Bernewitz

732 pages, 6x9 in.
140 illustrations

Cloth $3.00

A reprint of the leading articles on all phases of cyanidation. A permanent record of the experience and observations of nearly 200 men from all parts of the world. For convenience the articles have been classified and grouped under the following headings:

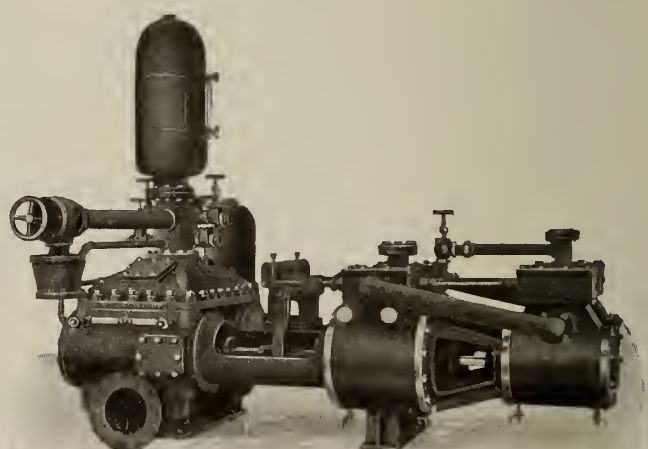
Historical. Chemistry of Cyanidation. Special Problems. Crushing. Concentration and Treatment of Concentrates. Roasting. Agitation. Decantation. Filtration. Precipitation and Clean-up. Disposal of Residue. Measurement and Estimation of Tonnages. Recent Cyanide Practice by Districts. Descriptions of Notable Mills Review of Progress by Years.

BOOK DEPT.

CANADIAN MINING JOURNAL
44-46 Lombard St., Toronto

Our Pumps are in use from Coast to Coast.

Try us when you are contemplating a purchase.



The Smart Turner Machine Co.
LIMITED
Hamilton, Canada

Printing!

Our Plant is Running Full Blast!

We wish to draw the attention of mining, metallurgical, and development corporations to our excellent facilities for compiling, arranging, illustrating, printing and distributing Annual Statements, Special Reports, Descriptive Pamphlets, etc.

We guarantee our work in all respects. In letter-press, half-tone engravings and reproductions in colour, we are prepared to give entire satisfaction.

We shall be glad to furnish estimates to enquirers.

ADDRESS

Industrial and Technical Press Ltd., 46 LOMBARD STREET, TORONTO

OR

Canadian Mining Journal, 2nd Floor, 44-46 LOMBARD ST., Toronto

SMART-WOODS, LIMITED

MONTREAL, OTTAWA,
TORONTO, WELLAND,
WINNIPEG.

DEPARTMENTS

CLOTHING
Workingmen's Shirts, Overalls, Pants, Underwear, Socks, Blankets.
Lumbermen's Supplies.

BAGS
Jute, Cotton, Seamless and Elastic Paper.

CLOTH
Cotton Cloths, Cotton Ducks, Twines and Yarns.

CANVAS
Tents, Awnings, Tarpaulins, Sails, Flags, etc.

Crown Brand.

BENNETT FUSE

BEST AND CHEAPEST FOR USE IN ANY SITUATION.

STOCKS IN ALL MINING CAMPS

Sole Agents for Canada except B.C.

LECKY & COLLIS, Limited

NAPANEE, Ont., and
335a Craig St. West. - MONTREAL

Wm. Bennett, Son & Co., Ltd., Camborne, Cornwall, Eng.

THE DAILY
Journal of Commerce

CANADA'S ONLY DAILY FINANCIAL NEWSPAPER

HON. W. S. FIELDING, President and Editor-in-Chief.
J. C. ROSS, M.A., Managing Editor
J. J. HARPELL, B.A., Secretary-Treasurer and Business Manager.

Special Wire to New York and Special Cable Service to London

Canada to-day has a yearly trade in excess of one billion dollars, while hundreds of millions of dollars of British and foreign capital is pouring into the country for investment. The country's banking institutions, her mining companies, her investment houses, her transportation systems, her manufacturing industries, her insurance companies and commercial houses compare favorably with those of any other country in the world. While the JOURNAL OF COMMERCE naturally deals chiefly with matters of finance and commerce, its news columns are by no means confined to that class of information. The general news of the day is covered in a condensed form and our aim is to present the very latest news concerning all important affairs. Whatever may be the important event of the moment, in any part of the world, it is promptly reported by the JOURNAL'S staff of correspondents.

Reliable News of all the Industries

Every person interested in Canadian Investments should be a Subscriber

SAMPLE ON REQUEST - - - SUBSCRIPTION PRICE, $5.00 PER ANNUM

Published Daily by

The Journal of Commerce Publishing Co., Limited

MONTREAL

Toronto Office: 44-46 Lombard St.

COLORADO

Mining Drill Steel

MANUFACTURED BY
Sanderson Bros. & Newbould, Ltd.
SHEFFIELD.

HOLLOW
Hexagon
SOLID

OCTAGON, HEXAGON, CRUCIFORM

Prompt Service from Large Stocks

H. A. DRURY CO., Limited

MONTREAL TORONTO NEW YORK

This New Bulletin has been published for your information and should be in your files. It gives complete information regarding the properties and characteristics of 30 per cent.

Colonial Copper Clad Wire

TRADE C.C.C. MARK

If you are interested in copper clad wire for bond wires, bare wires or strands, rubber insulated or weatherproof wires, *write our nearest office for C.C.C. Specification Bulletin.*

Standard Underground Cable Co. of Canada, Limited

Hamilton - - Ont.

Boston, Mass. Montreal, Que.
Seattle, Wash. Winnipeg, Man.

Manufacturers of Electric Wires and Cables of all kinds, all sizes, for all services, also Cable Accessories.

The Minerals of Nova Scotia

The extensive area of mineral lands in Nova Scotia offers strong inducement for investment.

The principal minerals are:—Coal, iron, copper, gold, lead, silver, manganese, gypsum, barytes, tungsten, antimony, graphite, arsenic, mineral pigments, diatomaceous earth.

Enormous beds of gypsum of a very pure quality and frequently 100 feet in thickness are situated at the water's edge.

The Province contains numerous districts in which occur various varieties of iron ore practically at tide water and in touch with vast bodies of fluxes.

The Gold Fields of the Province cover an area of approximately 3,500 square miles. The gold is free milling and is from 870 to 970 fine.

Deposits of particularly high grade managanese ore occur at a number of different localities.

Tungsten-bearing ores ot good quality have lately been discovered at several places and one mine has recently been opened up.

High-grade cement-making materials have been discovered in favorable situations for shipping.

Fuel is abundant, owing to the presence of 960 square miles of bituminous coal and 7,000,000 acres of woodland.

The available streams of Nova Scotia can supply at least 500,000 H. P., for industrial purposes.

Prospecting and Mining Rights are granted direct from the Crown on very favorable terms.

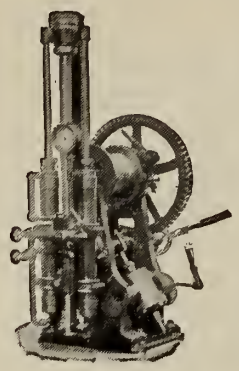
Copies of the Mining Law, Mines Reports, Maps and Other Literature may be had free upon application to

HON. E. H. ARMSTRONG,
Commissioner of Public Works and Mines,
HALIFAX, N. S.

Diamond Drills

For Prospecting

Machines of all Capacities.
Product of over 35 years experience.
Take out a Solid Core.
Bore at any Angle.



American Diamond Rock Drill Company

90 West St. NEW YORK

POSITION WANTED

As superintendent or foreman, by one who has had wide experience in Mechanical Construction, Draughting, Designing and Erecting of Mining Plants, Marcus screens, wash plants and buildings, cost estimates and supervision of all kinds of steam engines, boilers, air machinery, etc. References. Will accept small salary until value of services is demonstrated.

Apply Box 8, CANADIAN MINING JOURNAL, Toronto

DIAMOND DRILL CONTRACTING CO.

SPOKANE, - WASHINGTON.

Contractors for all kinds of Diamond Drill Work.
Complete Outfits in Alberta and British Columbia.
Write for Prices.

AGENCY:—
528 Pender St. West,
VANCOUVER, B. C.

DIAMOND DRILLS

Hand Power, Horse Power, Gasoline, Steam, Air and Electricity.

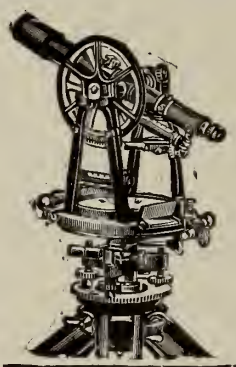
SEND FOR CATALOGUE

STANDARD DIAMOND DRILL CO.
745 First National Bank Building, CHICAGO, U.S.A.

MORRIS Q. E. F. RUNWAYS ARE INDEPENDENT OF BELTS, SHAFTS, BEAMS OR POSTS.

THE HERBERT MORRIS CRANE & HOIST COMPANY, Limited

EMPRESS WORKS, PETER STREET, TORONTO.



Berger TRANSITS AND LEVELS

Latest designs in Instruments for Underground Surveying for all classes of work. Complete Catalog fully describing and illustrating these instruments, with **a large Manual giving full and concise directions** in the **care, use** and **adjustment** of instruments will be sent on request.

C. L. Berger & Sons, Boston, Mass., U.S.A.

DOMINION BRIDGE CO., LTD., MONTREAL, P.Q.

BRIDGES

TURNTABLES, ROOF TRUSSES
STEEL BUILDINGS
ELECTRIC and HAND POWER CRANES
Structural METAL WORK of all kinds

BEAMS, CHANNELS, ANGLES, PLATES, ETC., IN STOCK

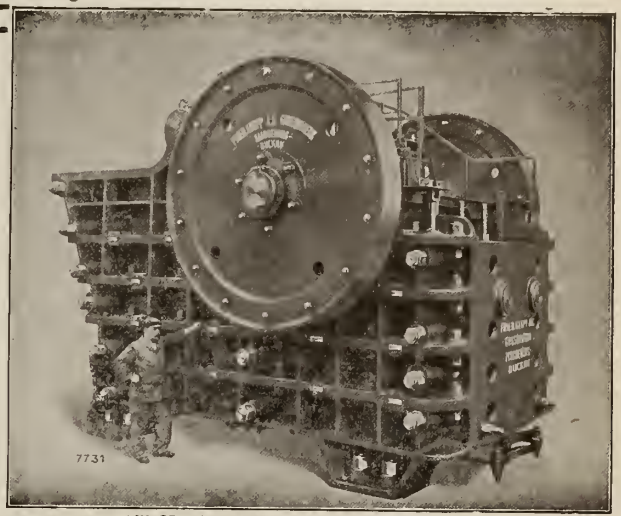
"KRUPP"

MINING-MACHINERY

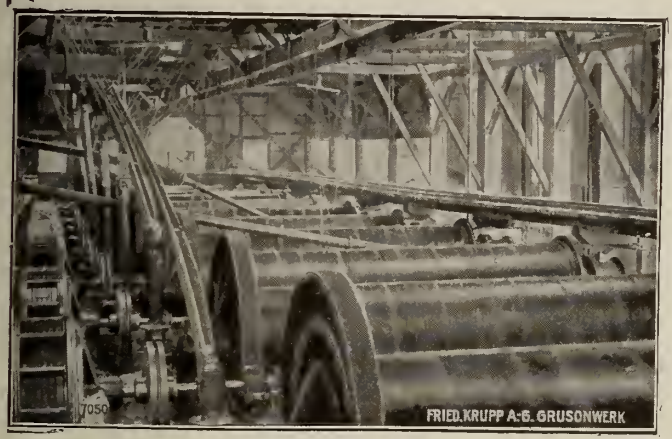
Ore and Rock Breakers, Rolls, Stamps, Shoes and Dies of Special Krupp Steel, Krupp Ball Mills for Dry and Wet Crushing Ores, Chilian Mills (Edge Runners).

TUBE MILLS FOR WET GRINDING

Concentration-Amalgamation-and Cyanide-Plants.



JAW CRUSHER, MOUTH 71 x 55 INCHES



WET GRINDING TUBE MILLS.

ULLRICH'S Patent Electro magnetic Dry and Wet Separator for strongly and feebly Magnetic Ores.

COMPLETE INSTALLATIONS

for the

TREATMENT of ORES of every kind

Plants for the Metallurgical Treatment of Ores.

FRIED. KRUPP A.-G. GRUSONWERK

MAGDEBURG (GERMANY)

Canadian Representatives:

JAS. W. PYKE & CO., Limited, 232 St. James St. Montreal

COMPRESSORS

FOR MINING WORK

LOW INITIAL COST **LOW MAINTENANCE CHARGES**

Manufactured by Belliss & Morcom, Ltd., England

LAURIE & LAMB AGENTS - 211 Board of Trade Bldg. MONTREAL

Our Business is to Reduce Your Handling Cost

By giving you the benefit of our long and varied experience in the Designing, Building, Installing and Perfecting of Machinery for the Economical Handling of all kinds of material.

MINING MACHINERY

Green Self-dumping Car Hauls and Transfer Dumps, Mine Cages, Skip Hoists, Screens, Pressed Steel Picking Belts, Drop Forged Steel Chain, Conveyors and Elevators, Coal Tipples, Coal Hoppers. Coal Crushers, Automatic Feeders, Belt Conveyors, Gypsum and Phosphate Machinery, Sand and Gravel Machinery, Rock Handling Plants, Dryers—Direct Heat and Steam, etc.

THE C. O. BARTLETT & SNOW CO.

MONTREAL, CAN. ENGINEERS and MANUFACTURERS OF CANADA, LIMITED

BRITISH COLUMBIA

The Mineral Province of Western Canada

Has produced Minerals valued as follows: Placer Gold, $72,194,603; Lode Gold, $70,859,022; Silver, $33,863,940; Lead, $27,520,753; Copper, $73,723,562; Other Metals (Zinc, Iron, etc.), $1,528,403; Coal and Coke, $132,871,155; Building Stone, Brick, etc., $17,576,084; making its Mineral Production to the end of 1912 show an

Aggregate Value of $430,137,522

The substantial progress of the Mining Industry of this Province is strikingly exhibited in the following figures, which show the value of production for successive five-year periods: For all years to 1892, inclusive, $81,090,069; for five years 1893-1897, $31,420,396; for five years 1898-1902, $77,218,073; for five years 1903-1907, $109,797,744; for five years 1908-1912, $130,611,240.

Production During last ten years, $240,408,984

Lode-mining has only been in progress for about twenty years, and not 20 per cent. of the Province has been even prospected; 300,000 square miles of unexplored mineral bearing land are open for prospecting.

The Mining Laws of this Province are more liberal and the fees lower than those in any other Province in the Dominion, or any Colony in the British Empire.

Mineral locations are granted to discoverers for nominal fees.

Absolute Titles are obtained by developing such properties, the security of which is guaranteed by Crown Grants.

Full information, together with mining Reports and Maps, may be obtained gratis by addressing

THE HON. THE MINISTER OF MINES
VICTORIA, B.C.

YOUR
Fine Ores, Concentrates and Fluedust

Can be Cheaply and Successfully Sintered by the

DWIGHT & LLOYD SYSTEM

(Fully Protected by Patents.)

SIMPLE, EFFICIENT, CONTINUOUS
LOW COST OF INSTALLATION

Many plants now in daily operation in U.S., Dominion of Canada, Republic of Mexico, Australia and European Countries. For particulars as to Licenses in Canada, Estimates, etc., address

Dwight & Lloyd Sintering Co., Inc.
(Successor to Dwight & Lloyd Metallurgical Co.)

29 Broadway, New York.

Cable Address: SINTERER, NEW YORK

"For information regarding sintering of iron ores and iron flue dust, consult special licensee."

American Ore Reclamation Co.
71 BROADWAY, N.Y.

"B.C." Mining Drill Steel

The Steel with a Reputation

Has stood the test in Canada for Twenty years.

Manufactured by

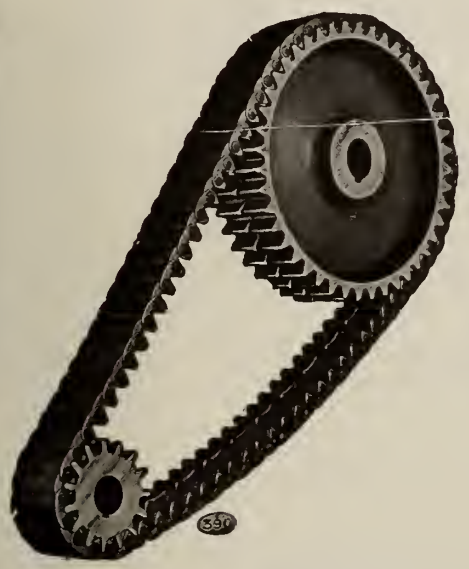
B. K. MORTON & COMPANY

SHEFFIELD, England.

Full Stocks carried by

Montreal: The Canadian B. K. Morton Co., Ltd.
Toronto: Baines & Peckover.
Cobalt: The Canadian Rand Co., Ltd.
Victoria B.C.: E. G. Prior & Co., Ltd.

RENOLD PATENT SILENT CHAINS



The advantages are :—

Saving in Space

The chain drive only occupies one-third of the space occupied by the belt, as with chain drive it is possible to place the motor close to the shaft without any sacrifice of efficiency.

Saving in Power

Chain Drives being positive, there is no initial tension as with belts, and therefore none of the journal friction so caused. Consequently all the power is applied economically.

Regularity of Output

With the chain the speed ratio is perfectly definite under all conditions of load. This ensures a steady output with not only an increase in quantity but generally an improvement in quality.

Many other advantages given in illustrated catalogue sent on request.

JONES & GLASSCO (Reg'd) Engineers

Sole Canadian Agents

Branch Office, Toronto **49 Place D'Youville, MONTREAL**

Motor Capacity is more important than Price Per Pound in the selection of a Mine Locomotive

Buying an undermotored locomotive because it is cheap for the weight is not always economy. A smaller locomotive fully motored will do exactly the same work at less cost for current consumption, upkeep and maintenance.

Jeffrey Electric Mine Locomotives

are equipped with Heavy Capacity Ball Bearing Motors which permit the locomotive to operate up to the slipping point of its wheels without overheating or burning out any part of the motor.

Ball Bearings on the armature shaft permit of large motor capacity for narrow gauges in metal mines.

Write for leaflet No. 19-A, illustrative and descriptive of Jeffrey Ball Bearing Motors. Also our complete Mine Locomotive Catalog No. 117.

Jeffrey Manufacturing Company

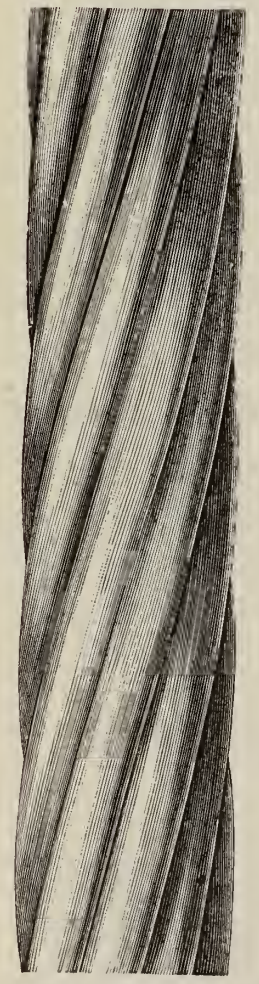
Canadian Main Office and Works, Montreal

6-Ton Electric Locomotive, designed and built especially for Ore Mines

BANKHALL

Hoisting and Haulage

ROPES



Have all the good qualities of the best British Manufactured Cables. Special attention is given to the material, construction, and every wire is minutely tested for breaking strain, elongation, torsion and flexion.

The best ropes for hoisting, hauling, winding, etc., etc.

STANDARD SIZES AND STYLES CARRIED IN STOCK

SOLE CANADIAN AGENTS

MUSSENS LIMITED

MONTREAL, 318 St. James St.
TORONTO, 155 West Richmond St.
QUEBEC, 31 St. Louis St.
COBALT, Opp. Right of Way Mine
WINNIPEG, 259-261 Stanley St.
CALGARY, 10th Ave. and 3rd St. E.
HALIFAX, 78 Granville St.
VANCOUVER, 101 Water St.

THE CANADIAN MINING JOURNAL

VOL. XXXV. TORONTO, June 15, 1914. No. 12

The Canadian Mining Journal

With which is incorporated the

"CANADIAN MINING REVIEW"

Devoted to Mining, Metallurgy and Allied Industries in Canada.

Published fortnightly by the

MINES PUBLISHING CO., LIMITED

Head Office - - 2nd Floor, 44 and 46 Lombard St., Toronto
Branch Office - - - - - - - 600 Read Bldg., Montreal.
London Office - - - Walter R. Skinner, 11-12 Clement's Lane London, E.C.

Editor
REGINALD E. HORE

SUBSCRIPTIONS—Payable in advance, $2.00 a year of 24 numbers, including postage in Canada. In all other countries, including postage, $3.00 a year.

Advertising copy should reach the Toronto Office by the 8th, for issues of the 15th of each month, and by the 23rd for the issues of the first of the following month. If proof is required, the copy should be sent so that the accepted proof will reach the Toronto Office by the above dates.

CIRCULATION.

"Entered as second-class matter April 23rd, 1908, at the post office at Buffalo, N.Y., under the Act of Congress of March 3rd, 1879."

CONTENTS.

Editorials—	Page.
Calgary Oil Field	397
Nova Scotia Coal	397
Technical Education in Nova Scotia	398
Sheep River Gas and Oil Field, Alberta, by D B. Dowling	399
Cementing Oil and Gas Wells, by I. N. Knapp	405
Determination of Properties of Petroleum, by I. C. Allen and others.	411
The Origin of Petroleum, by Hans Von Hofer	413
The Illinois Oil Fields, by H. A. Wheeler	415
Mining as a Profession, by Hennen Jennings	416
Hammer Drills vs. Reciprocating Drills, by P. B. McDonald	417
Natural Resources of Canada, by F. D. Adams	419
Personal and General	425
Special Correspondence	426
Markets	432

CALGARY OIL FIELD

In view of the results obtained at the well of the Calgary Petroleum Products company, the recently issued geological map of the Sheep River Gas and Oil Field, Alberta, and the accompanying notes are of unusual interest. Last fall some account of the early discovery was given by Mr. R. W. Brock, Deputy Minister of Mines, and it was announced that Mr. D. B. Dowling had been assigned to study the district for the Geological Survey. Mr. Dowling prepared a geological sketch map of the area in which oil has been found, and this, with the accompanying memoir, is now ready for distribution. A considerable proportion of the text is reprinted in this issue of the Journal. In his report Mr. Dowling gives further details and useful notes on the occurrence of oil and gas in similar areas in the Western United States.

The map and memoir should prove very useful and the Geological Survey deserves great credit for placing them in the hands of the public at such a critical time.

Repeated warnings have been sounded against the reckless investment in shares of the numerous companies which have been recently incorporated. It is to be hoped that these warnings will be heeded. The capitalization of these several companies totals many millions and their properties are merely prospects. The recent strike has increased the value of the prospects, but the best properties are still in that class.

The results so far obtained must be very gratifying to those who are bearing the cost of the explorations. They may be expected to persist in their efforts. That there is oil has been demonstrated. Whether it occurs in large quantity remains to be determined. For the thorough exploration of the district there will be plenty of funds available. Experienced operators have been attracted by the possibilities of the Calgary oil field and vigorous exploration will be carried on.

NOVA SCOTIA COAL

Dullness in the iron trade in Canada and the United States continues, and the hoped-for revival seems as far off as ever. In consequence the iron and steel producers in Nova Scotia are having a very unpleasant time of it. The lack of orders for steel makes it more difficult to secure good sales for iron ore and coal.

Some of the coal mining companies are finding a fairly good market for their product. The Dominion Coal Co. is making large regular shipments, and President J. H. Plummer predicts a fairly good summer. On the other hand some mines are being worked only two or three days a week.

Nova Scotia has enormous quantities of coal and several of the mines have been well equipped. A much larger production can be made when the market warrants it and there will be a large production this year in any case. Coal mining should prove to be for many years one of Nova Scotia's greatest industries.

TECHNICAL EDUCATION IN NOVA SCOTIA

Considerable progress is being made in the provision of adequate technical education for the workmen of Nova Scotia. Largely through the efforts of Mr. F. H. Sexton, Principal of the Technical College of Nova Scotia, arrangements have been made for the holding of classes in many parts of the Province.

At the last annual meeting of the Mining Society of Nova Scotia a resolution was drafted asking that the recommendation made by the Royal Commission of Technical Education and Industrial Training, providing for increase in facilities for technical education, be carried out. The movement should prove a popular one. Enough has been accomplished to indicate that great improvement in the condition of the people can be made by giving the workman every chance to acquire technical knowledge.

CORRESPONDENCE

Editor Canadian Mining Journal:

Sir,—Appearing in your issue of June 1st is an article headed, "Report by the Provincial Assayer on the Surf Inlet Gold Mine, Princess Royal Island, B.C."

In this report measurements are wrong. Crosscuts are called drifts. Where the drift follows the foot wall it is said to follow the hanging wall, and where the vein could not be more perfect it is said to be broken up, thus showing that the writer had little conception of the facts before him.

It is stated in the summary of this report that the average assay value of the ore had not yet been determined. In justice to the management of the Surf Inlet property, let it be known that the Provincial Assayer was told that the average assay value of the ore was about $8.00. This has been determined by the manager, Mr. F. M. Wells, who is a thorough and competent sampler, and had his samples assayed by Mr. O'Sullivan, of Vancouver, and also by the writer, who was in charge, and accurately sampled and assayed the entire property. If the Provincial Assayer could take it for granted that the several crosscuts which he calls drifts were all in a fair grade of ore because we told him so, could he not have stated that the average assay value of the ore was about $8.00. He did not take a single sample underground, but relied entirely on the generosity of the management for his information.

In justice to the property and to Mr. F. M. Wells, who was the manager, it would be kind of you to give this letter space in your columns.

DAVID SLOCAN,
Rea Mine, Porcupine, Ont.

June 5, 1914.

OBITUARY

THE LATE ALFRED E. BARLOW

The awful disaster on the St. Lawrence river two weeks ago brought deep sorrow to many a Canadian home. Many who read the early accounts found that relatives or friends were among the missing. Mining men throughout Canada scanning the lists learned with regret that Dr. A. E. Barlow and his wife were lost.

Through his work in many parts of the Dominion, and latterly through his position of president of the Canadian Mining Institute, Dr. Barlow was very well known.

Alfred Ernest Barlow was born in Montreal, June 17, 1861. He graduated from McGill University, receiving the degrees of B.A. (1883). M.A. (1899) and D.Sc. (1900). He was in the employ of the Geological Survey of Canada for 23 years (1883-1906). In 1906 he resigned his position with the Survey to engage in private practice as consulting mining geologist. He lectured at McGill University during the past five years.

In his many years' work in the Government service Dr. Barlow became an authority on the Pre-Cambrian rocks of Northern Ontario. Among his most notable contributions are reports on the Sudbury nickel-copper district and the Haliburton corundum district.

Dr. Barlow was always an enthusiastic supporter of the Canadian Mining Institute. He gave much of his time to the furthering of the mining industry in Canada, and he was in 1913 elected president of the Institute.

CANADIAN MINING EXHIBIT AT THE PANAMA-PACIFIC INTERNATIONAL EXPOSITION.

San Francisco, June 10.

The Dominion of Canada will occupy a most prominent position among the foreign countries, officially represented at the Panama-Pacific International Exposition in 1915. The Canadian building, which is now under roof, will be completed and ready for the reception of exhibits in about three months. The structure, which is a triumph in architecture, has a length of 340 ft. a width of 240 ft. and a height of 50 ft. and will cost about $300,000. It will be the largest building ever erected by Canada at an international exposition, having about 65,000 ft. of floor space available for exhibits, and will present one of the most elaborate and comprehensive displays of the Dominion's resources and products ever shown on foreign soil. The total expenditure for the Canadian exhibition will be about $600,000. The exhibit will be entirely under the supervision of the Dominion Government.

The Canadian Commission is making a special feature of the mining exhibit, which will be the most comprehensive presentation of the mineral resources of any country shown outside of the Palace of Mines, the magnificent structure now being completed by the Exposition Company.

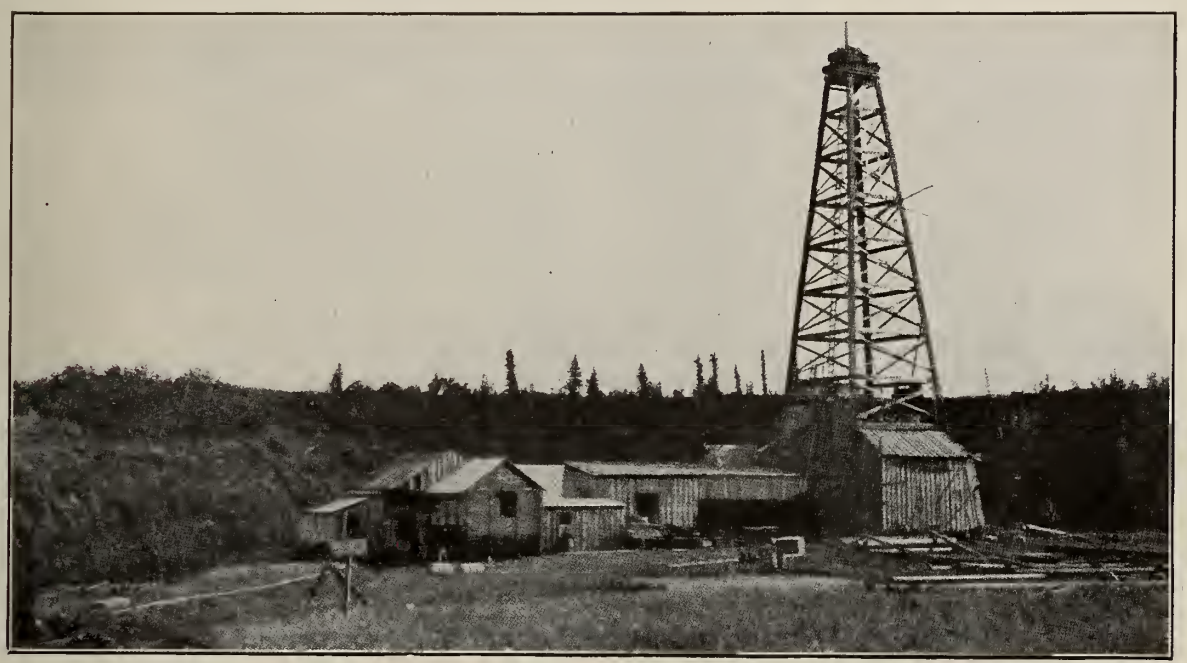
A country with such a record in mining will send many visitors to the Panama-Pacific Exposition who cannot fail to be deeply interested in the wonderful exemplification of the mining industry which will be presented in the Palace of Mines and Metallurgy. In this magnificent structure, which occupies an area 451 by 579 ft. more than 200,000 square ft. of floor space will be available for exhibits, and every state in the American Union, and nearly every country whose people are extensively engaged in mining will be represented.

SHEEP RIVER GAS AND OIL FIELD, ALBERTA*

By D. B. Dowling.

The western edge of the great syncline which runs north and south through Alberta and crosses obliquely the fifth initial meridian, is for a short distance bent over into anticlinal form. West of this, which is the region commonly called the foot-hill country, the rocks are faulted and folded, and exposures of the lower series of rocks are to be found on many of the streams. Where the above-mentioned anticline crosses Sheep River the rocks exposed by the erosion of the crest of the anticline are Upper Cretaceous shales. These, on the south branch of Sheep river, are well exposed beneath sandstones which appear to belong to the coal accumulated, but the broken nature of the country would argue against any very large reservoirs.

A sketch of the geological structure on a line of section across the strike of these beds in the Sheep River area appears on the map accompanying these notes. The most striking feature illustrated by this section is the apparent great depth at which the Cretaceous rocks are buried at points to the east of the Sheep Creek anticline, and, therefore, all drilling in the Tertiary areas must depend for a possible supply of oil or gas on the rocks forming the Tertiary beds. Up to the present a small flow of gas has been obtained



Calgary Petroleum Products Company's Well, Sheep River, Alberta

bearing Edmonton series of Northern Alberta or the St. Mary River beds of Southern Alberta. In the centre of the anticline, sandstones and shales of the base of the Bearpaw or top of the Belly River formation appear, and in these, near the south branch of Sheep river, a leakage of strongly smelling gas has been known for years at the apex of the anticline.

Recent boring operations in this vicinity disclosed the presence of gas in the upper beds of the Belly River formation and, at a depth of a little over 1,550 ft., a small amount of light oil (about 90 per cent. gasoline) was found. This stimulated the belief that oil was to be found in commercial quantities in this region and many companies were formed with the object of drilling for oil. Assuming that oil is to be found in the rocks of the Belly River, or those at a lower horizon, it would be essential to success that drilling should be started (1), at a locality where oil and gas might be expected to accumulate and (2), where it could be reached at reasonable depths.

The Sheep Creek anticline offers, as far as structure goes, an opportunity of piercing these rocks at a moderate depth. To the west in the faulted zone of the foothills, these lower rocks are again brought to the surface and there may be areas there where oil may have at several points, but this has been without much odor and the only oil found in Alberta in beds near this horizon is to the north, near Edmonton, in surface showings which have a possible origin in drift material brought from the Athabasca.

Extended notes on the geology of the foot-hill area southwest of Calgary will be found in a report by Mr. D. D. Cairnes on Moose Mountain region, Geological Survey Publication No. 968. Information of a more general nature on the geology of the northwest provinces is contained in Memoir No. 29 by Wyatt Malcolm, entitled "Oil and Gas Prospects of the Northwest Provinces of Canada." The following notes are intended to supplement the information therein given in regard to the possibilities of oil being found in the Cretaceous rocks.

Summary and Conclusions.

The boring on Sheep River has demonstrated the presence of small quantities of oil in the Belly River rocks, and there is a trace of oil in the weathered face of these sandstones in outcrops on the stream nearer the mountains.

Gas has been obtained at a number of localities in the Belly River formation.

*Extracts from Memoir No. 52, Geological Survey, Department of Mines, Canada.

The Cardium sandstone, which seems to represent the top of the Niobrara, is exposed on Sheep River, to the west of the Sheep River anticline, and paraffin and oil have been obtained from hand specimens by treatment with chloroform. This horizon is probably the source of much of the gas in the shallow wells at Medicine Hat.

The Dakota sandstone is in places, especially to the east where it is superposed on the Devonian, impregnated with bitumen and heavy oils.

The above three formations contain many sandstone beds which where porous may serve as reservoirs for the accumulation of oil or gas; but their accumulation in quantity depends partly on the structural form and mainly on the character of the surrounding shales. Traces of oil, it appears, can be found in many of the dark shales of the Cretaceous, and in the oil fields of the western states, such as Wyoming and Colorado, the finding of oil at the several horizons in the Cretaceous depends greatly on the presence of sandy porous beds in which it can accumulate. The anticlinal form is, in the majority of cases, necessary for the concentration of the oil into pools, but in very dry beds such as in the Florence field, Colorado, the oil acts as the heavier liquids and collects in the bottom of the basins or synclines.

The Sheep River anticline would seem to be a favorable situation for the concentration of any oil or gas in the rocks beneath, and by deep drilling the horizons which present possibilities, namely, the Belly River, the Cardium sandstone, the Dakota, and the Lower Cretaceous sandstones beneath, may be reached. The anticline in the first fault block to the west, namely the one passing near Lineham, affords a chance to reach the Dakota at a comparatively shallow depth.

General Geology.

The Macleod branch of the Canadian Pacific railway skirts the eastern edge of a belt of hilly country which lies to the east of the foot-hills proper. The rocks in these hills are of early Tertiary age and consist of light colored sandstones and clays that are exposed in the vicinity of Calgary and westward, on the Bow River. In the district under discussion these beds are found in the hills west of Okotoks and are there seen lying almost horizontally. To the west, up Sheep River, there are occasional exposures, and near the forks of the river the dip of the strata is to the east, thus showing the approach to the western edge of the syncline. The rocks beneath the heavy bedded sandstones such as are occasionally seen cropping on the sides of the hills, are apparently varicolored shales and sandstones dipping eastward and are in evidence on the banks of the stream north of the post-office at Black Diamond. From beneath these comes a thick series of sandstones which a short distance farther west are tilted at higher angles, and as coal seams are found with them, they may be provisionally correlated with the Edmonton beds. As these latter sandstones are of a harder nature than the rocks above and below, their presence is indicated by a line of hills crossing the river valley and through which the two branches of Sheep River have cut channels. This line of hills marks the eastern side of a long fold running parallel to the mountains, and, at a short distance west, a similar ridge seems to be formed by the westerly dipping beds of the same series, thus indicating an anticline. The rocks exposed across this portion between the hills, are dark colored marine shales representing the Bearpaw or upper portion of the Pierre-Foxhill formations. The intercalated fresh and brackish water member, the Belly River series, comes very near the surface in the centre of the anticline. The presence of a sandstone with markings resembling plants, indicates a change in condition of deposition, but, according to the record of drilling operations on this anticline, shales continued for nearly 300 feet before the sandstone series was reached. Westward of the sandstone rib on the west side of this anticline, a decided break or fault is indicated and lower beds have been brought up. These, both in thickness and composition, resemble the Bearpaw shales; but since at the top, overlain by black or brown shales, there occurs a sandstone member which is not to be found in the exposures of these shales to the east, it is concluded that they represent the Claggett which is below the Belly River. Marine fossils have been collected from this series, but they are not of species definitely characteristic of any horizon. These shales overlie the Niobrara-Benton and the Dakota, but no exposures of either are here found as the lowest beds of the anticline are shales of the same series. The axis of this anticline passes just to the west of Lincham ford. For some distance west, the shales continue with moderate westerly dips, but a broken zone is reached near the eastern boundary of section 33, in which there is considerable folding and the thin sandstones found in this shale series are repeated several times. This sandstone is probably the series called by Mr. Cairnes the Cardium sandstone and it is expected that in places some oil may be obtained from it. The outcrops in places are stained with paraffin which can be detected only by treatment with a solvent such as chloroform, and in this way a trace of a heavy oil can also be obtained. A band of steeply inclined beds of Belly River sandstone is found just above the mouth of Macabee Creek, and in these there are two horizons similarly stained with paraffin. One at about the centre is supposed to represent the beds from which some oil was obtained in the well being drilled on section 6, township 20, range 2. The shales to the east of this series of sandstones may possibly be the Claggett, but as their thickness is considerable and the sandstones at the base resemble the top of the Belly River series rather than the Cardium sandstones, they are provisionally called Bearpaw.

Description of Geological Formations.

The rocks exposed in the district, including also some of those found in the foot-hills to the west, are discussed in the general order of the following table:—

Tertiary	Paskapoo series of northern Alberta, or Porcupine Hill beds of Southern Alberta.
Cretaceous	Edmonton series of northern Alberta or St. Mary River beds of Southern Alberta.
	Bearpaw shales, the equivalent of the Pierre shales described east of the Alberta syncline.
	Belly River series.
	Claggett shales, the equivalent of the Lower Dark shales of Southern Alberta, or the lower part of the Pierre.
	Cardium sandstones.
	Niobrara-Benton shales.
	Dakota sandstones.
	Kootenay formation.
Jurassic	Fernie shales.
Paleozoic	

Paskapoo Series—The rocks of this series as exposed in Northern Alberta are thus described by J. B. Tyrrell: "The beds consist of more or less hard, light grey or yellowish, brownish-weathering sandstone, usually thick-bedded but often showing false bedding; also of light bluish grey and olive sandy shales, often interstratified with bands of hard, lamellar, ferruginous sandstone, and sometimes with bands of concretionary blue limestone."

The thickness in the outer edge of the foot-hills on flows of gas have occasionally been found as instanced in the gas well at High River, but there it is not certain that the beds are of purely fresh water origin.

In the valley of Sheep River these sandstones are exposed in horizontal beds in Wilson coulee near Sandstone station, and in the hills bordering the valley west to the forks. Near Black Diamond post-office a heavy bed of sandstone outcrops near the south branch in section 16, and west of this exposures of the variegated shales and sands of the base of the formation are seen

Geological map of part of Sheep River Gas and Oil Field, Alberta. Shows location of well of Calgary Petroleum Products Co.

Little Red Deer River was determined as being at least 5,700 feet.

In Southern Alberta the sandstones are comparatively soft with intercalated greyish and blackish shales, the lower beds (Willow Creek of Dawson) having a pronounced reddish or purplish tint. The series is so far found to be entirely of fresh water origin. A few coal seams in the lower part are found in the country between Calgary and Edmonton. No authentic records of oil having been found in rocks of this division are known, though there are unconfirmed rumors of oil being found in the country west of Red Deer. Small

with an eastern dip. The thickness of the formation here has not yet been measured but seems to be very great. East of the hill country the beds that are at the surface should be those of the lower and more shaly part.

The late Tertiary rocks of Texas produce in some of the domes both gas and oil. Veins of gilsonite, a hardened bitumen, are found in Teritary rocks of Middle Park, Colorado, and in the Green River formation in Utah. The great oil fields of California are mainly in late Tertiary rocks. The Tertiary rocks of Wyoming, the lower part of the Wasatch formation in

Carbon county, contain sandstones that yield 8 per cent. of oil with an asphaltic base.

Edmonton Series.—In the vicinity of Sheep River the series of sands and clays which form the base of the Paskapoo, merge into grey clays and sandstones in which one seam of coal is known and these are succeeded by more sandy beds. The base of the formation is distinctly a sandstone which is exposed on each side of the anticline, and being more resistant to erosion is marked in the topography by a series of long, narrow hills. The thickness of the sandstone rib is probably over 1,000 feet. In the foot-hills a second coal horizon is found near the base, though on Sheep River none was noted. The upper coal seam at Black Diamond and south near Tongue Creek is repeated on the west side of the anticline in the McDougall mine near Lineham post-office. Coal reported near the surface at the McDougall-Segur well may possibly have been from the lower coal horizon in the Edmonton.

Bituminous sands covered by boulder clay have been found at several places north of Edmonton. The origin of these sands is doubtful and there is a possibility that in some parts of the series a small amount of oil has been formed which has been collected in sands beneath the somewhat dense boulder clay. The possibility, however, of masses of the tar sands having been transported from the Athabasca county by the Keewatin glacier is not to be lost sight of. Drilling at these localities has been very expensive and has not proved the supposition that the oil found its way upward from the Dakota beds below. These pools of oil have, moreover, little value except when near enough the surface, so that the containing bed can be removed by excavating. The localities so far reported are: near Egg Lake, township 56, range 25, west 4th; section 28, township 56, range 2, west 5th; at Legal in township 57, range 25, west 4th; and north of the Athabasca on Freeman River, 12 miles above its mouth. Other localities whose positions are not definitely known are reported near the east end of Lesser Slave Lake.

Bearpaw Shales.—These marine shales occupy a position above the Belly River and are the equivalents of the Pierre-Foxhill of the plains of Alberta. The latter formation, as now understood, embraces also shales below the Belly River formation and hence individual names are required for the two divisions respectively above and below the Belly River.

In the foot-hill country, near the mountains, the thickness is found to be 650 feet. In the Calgary borehole, shales amounting to 530 feet are taken as representing this formation. At Kipp, borings show a thickness of 615 feet of shale above the Belly River coal seam. On the Red Deer River, east of Calgary, the thickness is about 750 feet. East of Edmonton it is about 800 feet and on the north slope of the Cypress hills McConnell found its thickness to be 900 feet. On Sheep River, between the limbs of the anticline, there are, east of the apex, two apparently unbroken series of shales with ironstone nodules and thin hardened streaks of sandy ironstone, separated by a very narrow band of shales with a discordant dip. These series each contain a section of shales, the eastern nearly 1,200 ft. and the western 800 ft. in thickness. At first view this would give a thickness of 2,000 ft., but as this does not seem warranted by the evident thickness elsewhere the presumption that there is a repetition somewhere in this setcion is warranted. The crumpled beds between the above-mentioned blocks are taken to represent a line of weakness and a possible normal fault is there assumed. Other faults may be present but were not detected and as a preliminary it is assumed that there is a thickness of 1,200 feet of shales as shown in what appears to be one block.

In Alberta and, probably, also Montana, these upper shales do not seem to contain oil. In Texas the beds representing the top of the Cretaceous contain oil in the Corsicana field and are supposed to have supplied the oil found in the Tertiary rocks at Beaumont.

Belly River Formation.—This is a brackish and fresh-water formation consisting of sandstones, shales, and a few coal seams. It very closely resembles the Edmonton formation and only by its position below the dark Bearpaw shales is its identity definitely known. According to Mr. Cairnes (Moose Mountain Report, No. 968, p. 27) the maximum thickness in the vicinity of the mountains is 1,025 ft. On Sheep River above the mouth of Macabee Creek, where these beds are marked on the Moose Mountain map, there seems to be a greater thickness than the above. In these beds signs of paraffin were detected on the outcrops in two places and these may correspond to the horizons at which oil was found in the well on section 6, township 20, range 2, west of the 5th meridian. Gas has been obtained from this formation in several places in Alberta besides the above-mentioned well.

Claggett Shales.—The shales lying below the Belly River rocks are marine and although very similar to the Benton, contain fossils that would place them higher in the series. They correspond in position to the Lower Dark Shales found by Dr. Dawson on Milk River near Lake Pakowki. These latter are classed by Stanton as being of Pierre age and representing the lower part of the Pierre shales as found in South Dakota. These beds are not found in any very great thickness in the foot-hills (150 to 300 ft.), and consist of dark shales with bands of ironstone similar to the shales above and below.

In Canada no reference has been made to the finding of oil or gas in these or in the lower Pierre shales, but in Wyoming some oil has been found in sandstones of the lower part of the Pierre, in the Powder River oil field, and also in the Salt Creek field in Natrona county. In Colorado, oil which is supposed to have come up from the Niobrara and Benton is found in the lower part of the Pierre in the Boulder and Florence fields. This horizon may correspond to the Claggett of Alberta.

Cardium Sandstones.—This division, which seems to represent shore and possibly land deposits formed at about the period represented farther east by the calcareous shales of the Niobrara formation, consists of coarse sandstones and black shales which have a thickness of about 50 to 100 ft. These are described by Mr. Cairnes and correlated with part of the Eagle sandstone of Montana. They are exposed on Sheep River as a narrow crumpled band at several localities west of Lineham post-office. The interest in this connection lies in the fact that several samples treated with chloroform imparted a decided brown-yellow color to this liquid. One sample so treated in the office at Ottawa, on evaporation left dark brown oily markings on the test tube and a large number of small needle-like particles, suggesting crystals of a white paraffin. This sandstone is a possible receptacle for oil that may come from the Benton shales beneath.

Niobrara-Benton Shales.—The upper part of this series may contain deposits of the same age as the Niobrara formation, but as these shales possess none of the Niobrara characteristics they are generally considered under the caption of Benton shales. This is

also the case in Montana where the formation derives its name. At the town of Fort Benton there is no limestone corresponding to the Niobrara, and as there is no erosion interval or unconformity the Niobrara is probably represented by shales or sandstones; in this particular the Benton shales of Montana and Alberta no doubt embrace more than the formation known by the same name in Nebraska.

In the eastern exposures of the Cretaceous in Manitoba and also at various places along the northern face of the Cretaceous plateau, calcareous shales are found beneath the Pierre, which seem to be of Niobrara age, and at several localities these have a strong odor of petroleum and are often so impregnated that the shales will burn. Petroleum may be obtained from them by distillation.

These bituminous shales are exposed in the valley of the Pembina River south of Manitou in Manitoba, and on the face of the Pasquia hills in Eastern Saskatchewan, and, as before remarked, the Cardium sandstones which represent a contemporary deposit in the foothills seem to have contained petroleum in same of their exposures.

South of the International Boundary, the oil in the Salt Creek field of Wyoming is supposed to come from the Niobrara, but it is found in sandy beds at the base of the Pierre. In Colorado the oil of the Rangely oil district is procured from the central part of the Mancos shale and, as this formation includes Pierre and Niobrara-Benton, the horizon at which the oil is found may correspond to the Niobrara. In the Niobrara of the Florence field the rocks of the Apishapa and Timpas divisions contain in the pores and small joints much solid bitumen. None is found in the larger joints.

In Canada no mention is made of oil or bitumen as having been found in the Benton shales. In Manitoba they evidently contain much carbonaceous matter, but in the foot-hills the characteristic intense black color is not so prominent and the shales are more rusty in appearance and may be described as dark grey, rusty shales with many thin bands of ironstone and rusty sandstone.

Oil is found in the Benton in Wyoming and Colorado. In the Wyoming fields of Unita county, oil is obtained in the Aspen formation northeast of Spring Valley, and in the Bear River formation near Spring Valley. Near Bonanza, oil is found in the Wall Creek sandstone near the base of the Benton. The upper part of the Benton in the Douglas field, Converse county, contains a very thick oil, while that from the lower part is much lighter in color. In the Colorado oil fields, the Carlisle shale in the upper part of the Benton contains oil in the Florence field, while in the Boulder field it is thought that some oil obtained in higher measures has worked upward from the Benton.

Dakota.—The thickness of the Dakota in the foothills is from 900 to 1,700 ft. Rocks very similar to those of the Dakota formation and probably of the same age, are found in the foot-hills region and will, probably, be penetrated in some of the deeper borings. In the foot-hill exposures these rocks are sandstones of a general greenish tint. Dark shale beds are found in the lower part of the series and the division between the Dakota and the Kootenay series below is not well marked, and has been here assumed at a heavy conglomerate bed which serves as a horizon marker for the top of the coal-bearing rocks beneath. This series of sandstones is an important gas reservoir in the anticline which passes north through the plains region between Bow Island and Medicine Hat. The great pressure of the gas and its economic value has until lately satisfied the companies drilling, so that the origin of the gas has not been determined. It is well known however, that where these beds rest on the Devonian rocks of the Athabasca River, they are impregnated with a heavy oil which on weathered outcrops is thickened to a bitumen. The origin has been ascribed to the Devonian beneath, and in this connection it may be mentioned that these oils and tars are found over a large area in isolated exposures. The tar spring on Tar Island, Peace River, and others in the country at the head of the Wabiskaw River, although found in rocks above the Dakota, probably derive their oil from the Dakota. The suggestion that this sand formation acts as a reservoir for oil extracted from Devonian rocks is quite plausible, since in the basin drained by the Mackenzie where a wide area of these rocks occurs, many instances of tar springs in the Devonian are known. Thus on Slave River, below Fort Smith, and at several points on the west shore of Great Slave Lake, there are evidences of petroliferous shales and tar springs. Others are to be found on the banks of the Mackenzie near Fort Good Hope and below Fort Wrigley.

The sandstones of the formation discussed under the name Dakota no doubt underlie a great part of the area occupied by the Cretaceous plateau, and the question of its oil or gas bearing qualities depends in great measure on whether the underlying strata are capable of producing oil or not. It is not expected that the Devonian is in immediate contact with the Dakota over the whole area now covered by the Cretaceous, since the contact is one of unconformity and in the exposures of the lower rocks in the mountains a great thickness of Carboniferous limestones and shales, as well as later beds, are there found between the Dakota and the Devonian. It may be that some of these intervening beds are themselves petroliferous or gas-producing, in which case the Dakota may have enriched zones that would in a general manner be aligned with the mountains and would also follow the structure lines or flexures on the plains.

The nearest of the foreign oil fields developed in this horizon is that of Wyoming. In several of the areas there prospected, the Dakota formation is credited with containing bitumen and heavy oil. In the Powder River field, Natrona county, some oil is found in sandstone doubtfully called Dakota, but which may be of earlier age. Dutton and Rattlesnake fields also credit some oil to the Dakota. In the Oil Mountain field there is one spring on Oil mountain in Benton shales, but the oil probably comes up through a fault from the Dakota. In several fields in Unita county, small amounts of oil are obtained from the lower part of the Benton or Dakota.

In Crook county a heavy lubricating oil is obtained from the Dakota. Some oil has been got from near the outcrop of the top of the Dakota in the Newcastle field of Weston county. In Converse county, oil that is found in the lower part of the Benton or top of the Dakota is lighter than that found in the upper Benton of the Douglas field. A very light oil has been found in the lower part of the Dakota in the Shoshone field of Fremont county.

In Colorado, solid bitumen is found in the Dakota. In the states to the south, the origin of oil in the Trinity sands (probably of this horizon) is generally

ascribed to the underlying Palaeozoic limestones and shales.

Kootenay.—This formation, which is generally very rich in coal deposits in the exposures in the Rocky mountains, thins out towards the east, so that its presence beneath the Dakota can only be expected in the western and perhaps southwestern portion of the Cretaceous area. The rocks are brownish sandstone and shales with abundant plant remains, and coal seams may be expected in the foot-hills area. This formation is found in Montana and thin deposits of about this horizon occur as far east as the Black hills. In the oil fields of Wyoming some oil is credited to sandstones at the base of the Cretaceous, which may be of this age, such as in Fremont county, and certain sandstones in the Douglas field of Converse county.

Occurrence of Oil and Gas.

Gas.—In Alberta, small quantities of gas are to be found in the sandstones of the Paskapoo and Edmonton formations. As these formations contain abundant evidence of plant life, both in the form of scattered material and in coal seams, the presence of gas may be expected; but as the beds are generally quite porous and are not capped by closer grained beds than the occasional clay deposits, the gas is probably to be obtained only in small amounts and at low pressure.

In the Belly River rocks which have a general resemblance to the Edmonton, the accumulation of gas is helped by the cover of close grained Bearpaw shales which overlie them, and although no great accumulations have yet been found in the prairie country, a very fair flow of gas was obtained in drilling on the Sheep River anticline. The gas was strong smelling and was evidently associated with a volatile oil.

Gas has also been obtained from rocks at about the horizon of the Niobrara at Medicine Hat and in Southern Manitoba.

The great flows of gas at Bow Island and at Pelican Rapids on the Athabasca, are believed to come from rocks at the horizon of the Dakota.

Oil.—The Devonian rocks of the Mackenzie basin have long been known to contain bituminous shales and they are also supposed to have been the original container of the oil found in the Tar Sand on the Athabasca. Small amounts of oil are known to exist in certain of the beds of the Niobrara as exposed in Southern Manitoba and Northern Saskatchewan. The percentage is, however, low and the oil could only be obtained by distillation. The value of these beds as sources of gas or oil, depends mainly on the presence of porous material above it, at the base of the Pierre, to act as a retainer. As remarked above, small flows of gas from this formation have been found near Treherne, Man.

In the foot-hills a sandy deposit at about the horizon of the Niobrara has been found in outcrop samples to contain paraffin and some oil, and it is expected that oil may be found at this horizon in the Sheep River borings.

The presence of oil in the Belly River formation at the well on Sheep River is the first intimation that the formation might be a source of oil, but an examination of the outcrops near Macabee creek revealed the presence of small traces of oil in these rocks so that the theory that this oil came up from below through faults or cracks at a recent date is not necessary.

SIXTH INTERNATIONAL CONGRESS
Of Mining, Metallurgy, Engineering and Economic Geology, London, 1915.

The next congress will be held in London, from Monday, July 12th, to Saturday, July 17th, 1915. The congress will be divided into four sections: mining, metallurgy, engineering and economic geology.

Participants in the Congress may be: (a) Honorary members and delegates of foreign states; (b) supporters of the Congress, that is, contributors of not less than £5 to the fund; (c) ordinary members who pay a Congress fee of £1, which entitles them to registration in any one of the four sections. These may register in any other sections by making a further payment of 5s. for each section.

The honorary members of the Congress and supporters will receive all publications of the Congress. Ordinary members will receive the transactions of that section in which they may elect to register by payment of the fee of £1. They can, however, receive the transactions of any other section on payment of the additional charge of 5s. per section referred to above. The Congress fee for ladies accompanying members is 16s. An application to join will be regarded as an undertaking to observe the by-laws of the Congress.

All participants will receive a card of membership and may take part in the discussions at meetings of the Congress and of the sections, in the excursions, and in the social functions. The authorized languages at the meetings are English, French and German. The official language of the Congress is English.

The Executive Committee have drawn up a list of selected subjects for discussion at the Congress, and have invited authorities to prepare papers thereon. In addition to these the Committee are prepared to accept a limited number of other papers, if found suitable for the objects of the Congress. All papers must reach the committee not later than January 31st, 1915. Papers may be submitted in any of the three authorized languages (English, French, German) and must be accompanied by a short abstract in the same language as the paper. The papers will be printed in one of the three languages, and the abstract will be printed in all three languages.

At the meetings of the sections of the Congress the papers will not be read, but authors will be invited to introduce the subjects of their papers for purposes of discussion. Except in special cases, the time allowed to authors for the introduction of their subject shall not exceed 15 minutes.

IRON ORE SHIPMENTS.

Shipments of iron ore from lake ports in May amounted to only 3,852,063 tons, as compared with 7,284,212 tons in May of last year.

Shipments to June 1 of this year were 4,121,749 tons; compared with 8,150,599 tons last year.

PORCUPINE.

Porcupine is making good progress. The Hollinger and Acme mines are in splendid shape. The Porcupine Crown and McIntyre mines are producing regularly. The Schumacher is being developed slowly, but with fairly good results. The Jupiter is developing good ore. The Vipond has been reopened. The Rea mine is being worked again and exploration is being carried on in the hope of finding ore at lower levels.

CEMENTING OIL AND GAS WELLS*

By I. N. Knapp.

I herewith present some notes on the use of Portland cement to cement in the casing, and for plugging, to exclude water from oil and gas wells, and the methods employed. I have used my best efforts to make each step of the operation of cementing wells prefectly clear. The information is the result of actual experience and observation.

If any formation does not give a satisfactory seat for a casing shoe, a wall packer, or a plug to exclude water from a well it becomes necessary to use a hydraulic cement. Portland cement mortars are best adapted for the purpose and neat cement only should be used in cementing in casing, for reasons given later.

Use of Mud in Cementing and Drilling.

It is necessary to use a mud mixture in any well to be cemented so as to exclude all oil, gas, or ground water, and such mud is circulated and made to carry the cement to place but not to mix with it.

Mud-ladened water is used in drilling by the hydraulic rotary method to seal off all porous strata immediately as encountered by the drill; also to counterbalance any tendency of ground water, oil, or gas running into the hole.

It is fundamental in drilling by the method mentioned that such mud circulation must go down through the drill pipe and bit and up the walls of the well and overflow to a mud pit at the surface.

Plastic materials such as are cut up by the bit and carried up the hole by the circulation are by the wobble of the drill pipe plastered and rolled into the walls of the well, thus giving any sand strata encountered a plastic covering.

Wells in unconsolidated materials consisting of sand, gravel. mud. and clay skilfully drilled by this method and kept full of mud at all times do not cave when the drill pipe is withdrawn and will remain clear for days so a pipe can be run to bottom without being "pumped down" and the mud circulation restored preparatory to cementing.

There are in very rare cases coarsely porous or cavernous limestones that cannot be mudded off in the usual way.

Capt. A. F. Lucas, in his early experimental drilling in Louisiana and Texas, demonstrated some 15 years ago the use of mud in drilling soft formations to keep the holes in shape and overcome gas and water pressures, and its use became general in the Texas and Louisiana oil fields some 12 years ago, and since in California.

Results with the Use of Mud.

As a practical matter, drilling with the hydraulic rotary method and using 25 per cent. of mud, I have repeatedly sunk through a gas horizon between 1,500 and 1,600 ft· deep, where there was a measured gas pressure of 650 lb. per square inch, set a screen in this horizon and cemented in a casing above the screen without a bubble of gas showing, and not until the pressure was reduced by bailing of the well did gas show.

Also, by the same method I have drilled through a known artesian water-bearing horizon between 1,900 and 2,000 ft. in depth without any sign of its existence, such as increase in the overflow, or of much loss of mud to the porous strata. In this water well a 6⅝-in. casing was set at about 1,880 ft. with a rubber wall packer and then drilled to 2,007 ft., when clear fresh water was pumped in through the drill pipe. When the mud was washed out the well began to flow and the drill pipe was withdrawn. This well threw out considerable sand, shells, and pieces of rock, possibly 30 or 40 cu. yd. in two days. In the course of a week the water ran practically clear and reached a steady flow of about 450 gal. per minute at the surface and gave a static head of about 80 ft. It had 80 ft. of surface casing and was then drilled 1,800 ft. without difficulty, passing three known water-bearing horizons and many loose sand beds, but the hole being always kept full of mud did not cave and the drill pipe could be left in over night with no sign of sticking.

Also, wells are frequently drilled into an oil-bearing horizon without showing a sign of oil, the only guide being the known depth to the oil sand in adjacent wells and the taste of oil in the particles of old sand in the overflow.

This brings out the extreme difficulty in prospecting for oil, gas, or water using the hydraulic rotary method of drilling.

Preparation for Cementing in Casing.

A well properly drilled by the method before mentioned and kept full of mud is in perfect condition for cementing. Wells drilled by other methods should be lubricated or filled with mud. Before running in the casing it is best to make sure such casing will go to the bottom and turn freely in the hole. This can be done by running in say three joints of the size of casing to be used on a string of drill pipe to the bottom of the hole. It may be necessary to put a rotary shoe on the end of the casing for removing lumps or straightening crooks in the hole. When the pipe is at bottom a proper mud circulation can be established and all water (salt, alkaline, or potable) as well as any oil or gas can be completely excluded and the well brought to condition for successful cementing.

The amount of cement to be provided may be roughly estimated by assuming that one sack (95 lb.) of neat cement mixture will fill 1.25 cu. ft. of space.

If, for instance, an 8-in. pipe is to be set in an 11-in. hole it will take between 20 and 25 sacks of neat cement to fill the calculated space for 100 ft. There should be provided a mixing box about 5 ft. wide by 8 ft. long by 18 in. deep with gate at one end to draw off the mixed cement, two cementing plugs, bottom and top (see Fig. 1) two mortar hoes, four shovels, two galvanized iron buckets, and a barrel to dip water from; also some sort of screen to pass the dry cement through to break up and take out lumps before mixing. Six men with a box of the size named and with the tools indicated will mix 10 batches of eight sacks each in 1 hr. It is desirable to get the mixed cement in place as quickly as possible and 1 to 1½ hr. is about the limit of time in which cement may be mixed for any one job of casing cementing and run in place. If more than 80 sacks of cement are required, a larger mixing box, or two boxes and more men, or a machine cement mixer will be required.

Mixing Cement Mortars.

It is impracticable to specify any particular percentage of water to be used in mixing cement neat or

*A paper presented at the New York meeting, A.I.M.E., February, 1914.

with sand. The best guide is to use the least possible amount of water practical for the work in hand.

As hydraulic cements require water to cause them to set and they will also harden immersed in water it is a common error to suppose they cannot be harmed by an excess of water. Experiments show that any excess in mixing is weakening in effect and retards setting and hardening. In fact, a large excess of water with prolonged mixing makes a mortar that will not properly harden at all.

If for instance eight sacks of cement are mixed with 18 buckets of water and the mixture works up too thin reduce next batch to say 16 buckets. In all cases make some measure of the water to get a uniform mixture of cement going into the hole.

Methods of Cementing in Well Casing and Plugging Wells.

There are several methods of doing this, such as: (1) Lowering the cement mixture in a dump bailer, particularly for plugging wells. (2) Pumping the mixture through a tubing properly arranged to force such mixture outside the casing. (3) Using two cementing plugs and pouring or pumping the mixture in the casing and forcing it down and up outside the casing by pump pressure.

The first method is unreliable and uncertain even in plugging a wet hole. Its use should not be attempted to cement in casing.

The second method is open to the objection of having a string of tubing to manipulate with the casing to be set and as ordinarily used with one cementing plug gives a wet string of tubing (pipe full of water) to pull out.

The third method of using two cementing plugs and displacing the mud with cement by gravity or pumping, as hereinafter described, is in my experience the best for general purposes, as it can be used with the certainty that the cement will be forced by pump pressure into the space between the casing and wall of the well in the shortest possible time and with the least chance of contamination of the cement mixture. There are other methods of cementing with which I am not familiar.

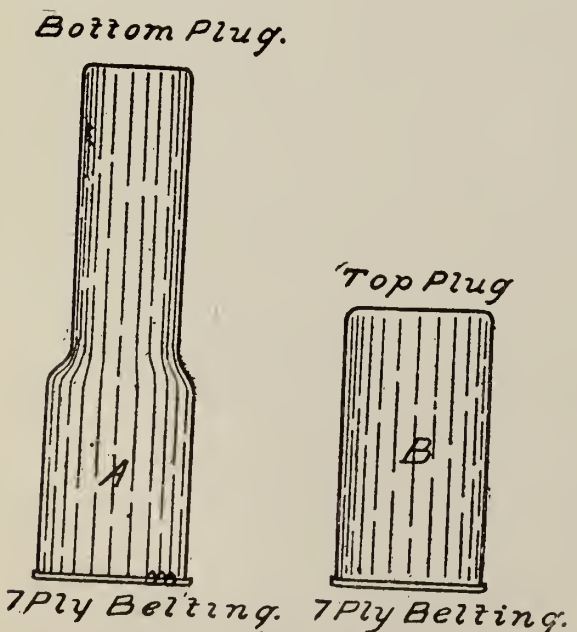


Fig. 1. Cementing Plugs.

The plugs, Fig. 1, are made of any soft wood that will drill out easily and of a diameter to pass freely through the pipe in which they are to be used.

The bottom plug (A) should be 30 to 36 in. long, to run in a 6 or 8 in. pipe, and other sizes in proportion. The full-size portion of the plug should be 6 or 8 in. long and the diameter then reduced to 4 or 5 in. for the rest of its length.

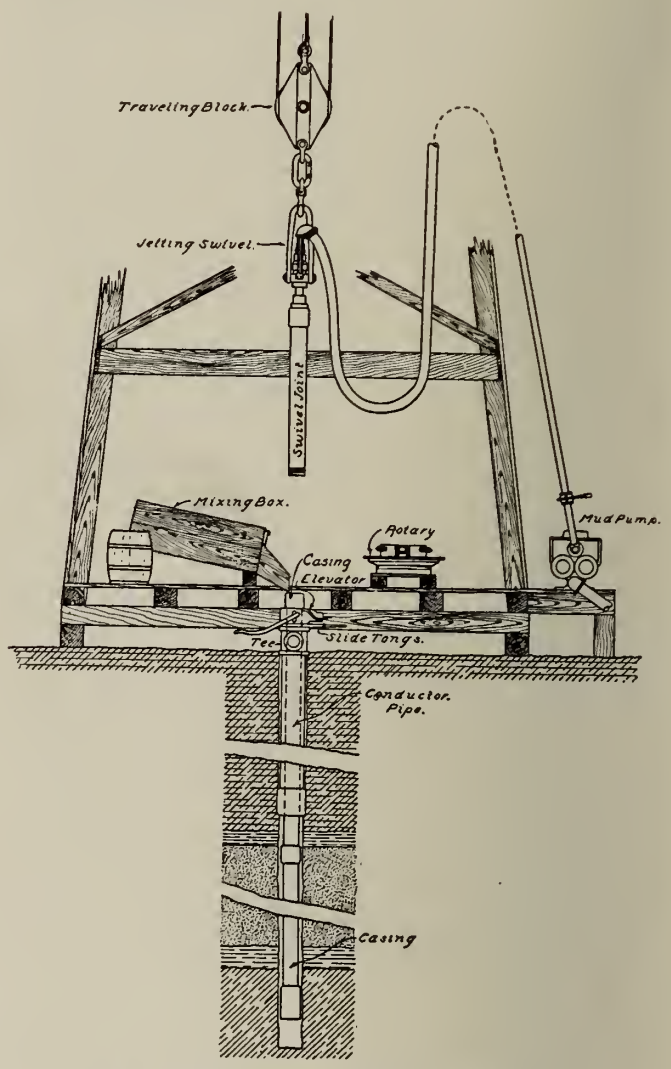


Fig. 2. Introducing Cement by Gravity.

The top plug (B) should be about 8 or 10 in. long for the same sized pipes. Both plugs are faced on the bottom ends with one thickness of 7-ply rubber belting so that they will fit snugly in the casing. These pieces of belting act as scavengers; the one on Plug A cleans the inside of the pipe of mud as it descends so as not to adulterate the cement; the one on plug B tends to keep all the cement pushed ahead of it.

Explanation of Cementing Operations.

Fig. 2 indicates how the cement may be introduced into the well by gravity. It shows the lower panel of a derrick with mud pump and connections to jetting swivel, also the traveling block. The rotary is set to one side. A conductor pipe is indicated as set in the well with the top coupling replaced with a tee. The overflow from the well may thus be piped through the conductor pipe and tee to the outside of the derrick. In running the casing, as shown, into the well, the cementing plug A should be run through each joint as it is hoisted up in the derrick to be connected, in

order to make sure that there are no blisters, dents, or other obstructions in them. The casing is lowered to bottom, marked, pulled back just enough so the mud will circulate freely by pumping, and again marked.

After the mud in the well and pits is evenly tempered by circulation, the casing is hung on the slide tongs and elevators placed on the tee on the conductor pipe just under the derrick floor. The swivel joint is unscrewed and set back. In order that the casing will take the cement by gravity the well is bailed down about 200 ft. by displacing the mud with the drill pipe or by bailing in the regular way.

If there is danger in bailing of a gas blow-out or a cave-in from water pressures then other methods must be employed as hereinafter described.

The well and casing should be kept covered at all times so that nothing can fall into the hole. After bailing, the swivel joint is hooked on again and hoisted out of the way to be ready for instant use.

The casing is indicated in the figure in place ready for cementing. The mixing box is placed so that when the end gate is opened the mixed cement will flow into the top of the casing. The water barrel is placed conveniently near and means for filling it quickly must be provided. The cement required should be stacked on the derrick floor and all the necessary tools assembled.

The dry cement should be dumped from the sack onto a screen, temporarily placed over the mixing box.

It should not be attempted by this method to put in more than 80 sacks (95 lb. each), as this is about the limit than can be mixed in one hour, with seven men and the appliances mentioned. Everything being ready, the first batch (8 sacks) is mixed, the cover taken off the casing, the plug A dropped in small end up, and the cement mixture run in. It is best to pass it through a wire screen (⅜-in. mesh) as it flows into the casing, so as to break up any dry lumps.

The succeeding batches are mixed and run in as rapidly as possible. The neat-cement mixture being

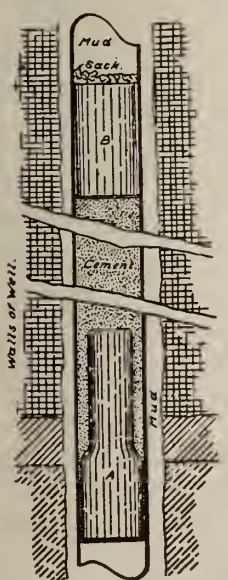


Fig. 3. Cement between plugs, passing down pipe.

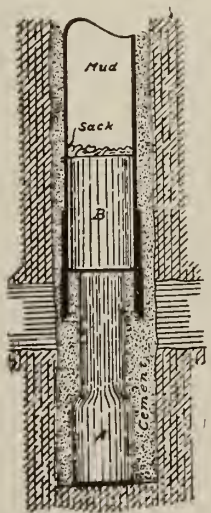


Fig. 4. Cement in place. Plugs meet.

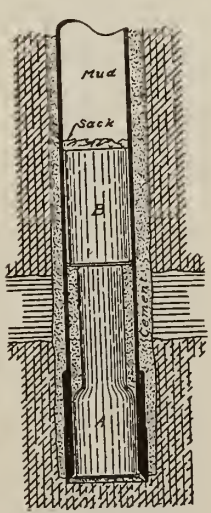


Fig. 5. Casing set on bottom, cementing completed.

much the heavier will force the mud down and then up outside the casing. If the casing is hung up more than 12 or 18 in. from bottom, care must be taken not to push the plug A below the casing before being brought to the position as shown in Fig. 4.

The required amount of cement having been put in, the plug B is dropped in with a cement sack on it as a packer against the pump pressure, the swivel joint connected, the elevator and slide tongs removed, the casing lowered to 12 or 18 in. off bottom and the mud pump started.

After the mud pump has run long enough to fill the swivel pipe and some pressure is shown by the pump gauge it should be stopped and the vent cock, indicated in Fig. 6, opened to let out the imprisoned air. If air is allowed to remain in the casing, or if the suction pipe of the pump or the piston rod packing leaks, such air becomes highly compressed into bubbles in the mud and may cause trouble. Meantime the mud pit is stirred up to make the descending column of mud as heavy as possible to counterbalance the cement column outside the casing. The number of revolutions required for the pump to fill the casing should be calculated and count kept to anticipate about when the cementing plugs should meet.

The cement column is forced by the pump down the casing between the two plugs as indicated by Fig. 3. When the first plug gets to the bottom of the well it goes partly out of the casing as indicated by A, Fig. 4, and allows the cement to pass outward and up between the casing and the walls of the well. The cement floats the mud and it is pushed upward by the pump pressure.

When the plug B meets the plug A, as indicated in Fig. 4, the cement is all out of the casing and the pump stops short by reason of the plug obstruction and the sack packer. The casing should now be given a few turns in the hole to distribute the cement. This can easily be done by two men with a chain tongs. The pump pressure remains on and the casing is set on bottom as indicated by Fig. 5.

The vent is then opened and there should be only a slight back flow, say a barrel of mud, if all air has been vented at the proper time, and the casing shoe is tight. It will be necessary to hold the pump pressure for 24 hr. if there is a strong back flow.

Objections to Cementing by Gravity.

This method requires a reduction of the mud head in the well by bailing and gives opportunity for a gas blow out or for oil or ground waters to enter and cave the well.

Also, the lower end of the casing is open, which may act as a scraper against the walls of the well and the casing may become filled with thick mud enough to prevent the passage of the plugs. It is the practice of some, after a string of casing with the lower end open is run in and the mud circulation established, to hang up the casing, unscrew the swivel joint, throw in a cement sack and pump it down to make sure the casing is clear before cementing.

If there is no danger in bailing the well down, or in plugging the lower end of the casing with the thick stuff, and 80 sacks or less of cement is to be used, the gravity method is, I think, the best that can be devised.

Necessity of Using Neat Cement.

By the means described the neat cement reaches the bottom of the casing with but little if any contamination.

The only means that we have of scavenging the outside of the casing and walls of the well is by floating the mud up and displacing it with the cement mixture.

The heavier the cement the better this action, hence it is desirable to use a cement neat and not reduce it with sand. The cement gets contaminated and mixed to an unknown degree with the mud clinging to the outside of the casing and the walls of the well, which also makes the use of a neat cement practically necessary.

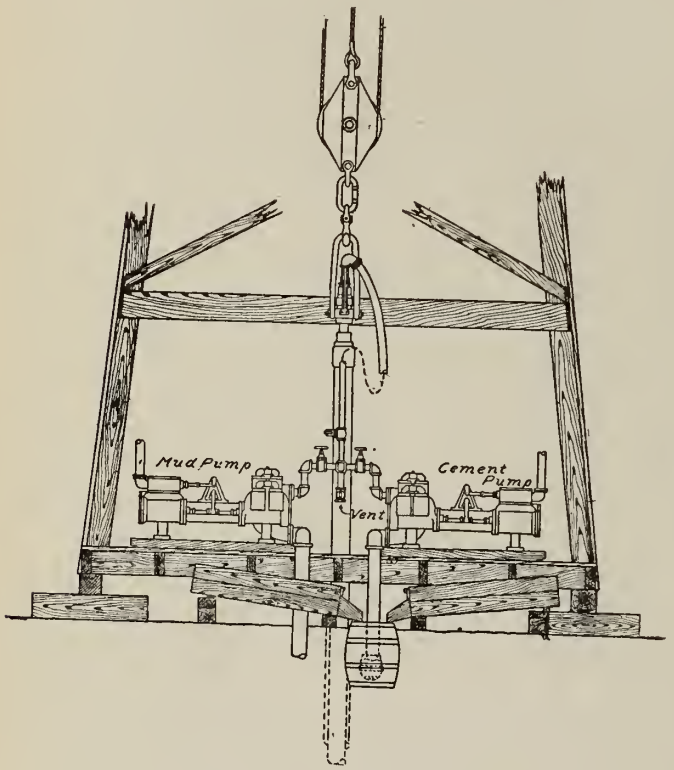


Fig. 6. Introducing Cement by Pumping.

Fig. 6 indicates a general surface arrangement for pumping the cement into the casing. The view is at right angles to that shown in Fig. 2, with two pumps set as commonly used in rotary drilling.

To increase the cement-mixing facilities, two mixing boxes can be used as shown, or a machine mixer employed. The mixed cement is drawn into a barrel, sunk below the surface. The suction pipe of the pump to the right is extended into the cement barrel and the pump to the left has its suction opening in the mud pit (not shown).

The manipulation is the same as in the gravity method of putting in the cement, except that when the plug A has been dropped in, the swivel joint is again connected, and the cement pumped in. When the cement is all in, the vent cock is opened; air will be drawn in because the descending column of cement will push ahead the lighter mud and make a vacuum.

The swivel pipe is then disconnected, the plug B and sack put in; the pipe is again connected, and the mud pumping started. I usually arrange for the mud pump to discharge into the cement barrel so that the cementing pump will run on mud and thus clean itself and the connections of cement. Since the surface of the cement may fall 100 ft. or more and the casing fill with air when opened, it is essential to vent this air, after the pump gauge shows some pressure, as before described.

Advantages of Pumping Method.

By this method no bailing of the well is required, so the danger from blow-outs and cave-ins is eliminated. Also a much larger quantity of cement may be handled in a given time than can be run in by gravity.

Improvement on the Cementing Methods Described.

The bottom cementing plug A has to pass partly out of the lower end of the casing in order to become operative by the common method and this prevents the use of a back-pressure valve. As the use of such valve together with two cementing plugs was desirable in deep (2,000 ft.) well cementing operations, I invented a method for the simultaneous use of both, as shown in operation in Fig. 7.

This apparatus consists of a double-swedged, by-pass nipple (if for an 8-in. string) made of a piece of 9-in. pipe, about 24 in. long, swedged to 8 in., threaded on both ends and couplings screwed on. Near one end of the 9-in. section two brass bars are put across at right angles, thus forming a rest for the bottom plug, and when the plug is in the position shown the cement is by-passed so the plugs can meet.

The brass bars can be made of ¾-in. brass pipe. They must be substantial, since the pump pressure may rise to 400 lb. and throw 10 tons pressure on them when the plugs meet. A back-pressure valve is screwed into the bottom coupling on the by-pass nipple as shown in Fig. 7. This should be a substantial brass valve for deep work. The bars and valve are made of brass so that they can be easily drilled out, with the wooden plugs, at the proper time.

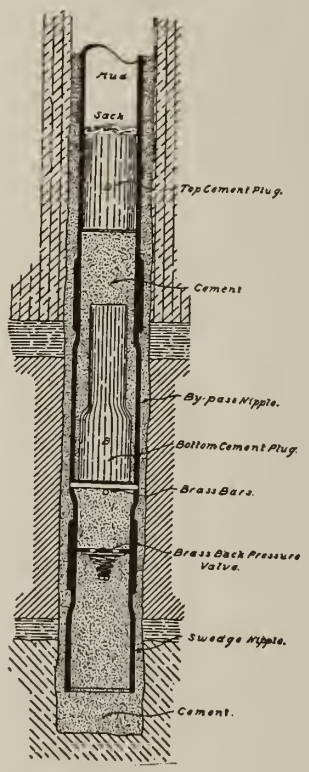


Fig. 7.

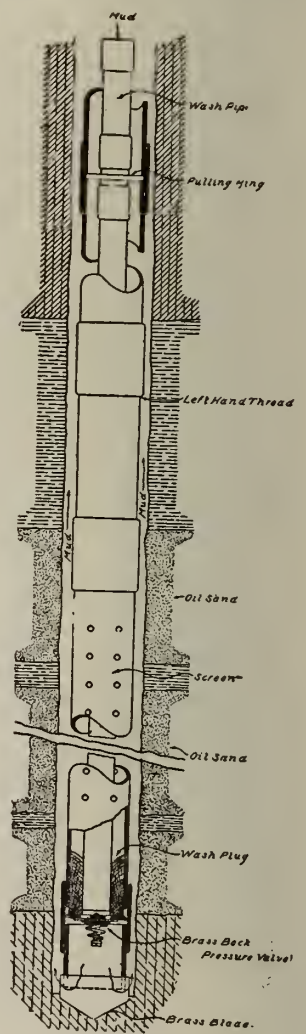


Fig. 8.

Under the back-pressure valve is fitted a 9 to 8-in. swedged nipple not threaded on the 9-in. end. This acts as a casing shoe and protects the valve.

The two couplings on the by-pass nipple should be screwed up as tight as possible and then pinned or

riveted in each thread. When the wooden plugs, brass bars, valve, and cement are being drilled out there is a possible danger that these threads may work loose by the action of the drill and the parts unscrew. This would make trouble and should be avoided.

Advantage of Using the Double-Swedged Nipple.

This invention (not patented) prevents the possible accidental passage of the cementing plugs out of the casing and permits the use of a back-pressure valve. This valve prevents thick mud from being forced back into the casing. The casing can be partly floated, thus making a long string much easier to handle. The casing can be bailed down to take any quantity of cement by gravity without endangering the well, also the cement mixture after passing the valve cannot flow back into the casing. The cementing operation may be done by gravity or pumping as before described.

Setting Screen and Cementing Casing Above.

When casing cementing is required, it is usually necessary also to set a screen, to make a proper test for oil or gas or bring a well in from a known horizon. In such cases I prefer to set a screen the full size of the casing required, for the closer the screen fits to the walls of the well the better for the well.

The screen with two joints of the same size casing above may be run in on a string of drill pipe.

Fig. 8 shows a screen set in place with all necessary fitting. The brass blade shown at the very bottom is to produce friction in order that the left-hand thread at the top of the screen may be easily unscrewed at the proper time. The short one-thread nipple is to hold the brass blade and protect the back-pressure valve. This valve is for the purpose before described and permanently closes the lower end of the screen when set. The wash plug in the lower end of the screen serves as a guide and packer to the wash pipe. The function of the wash pipe is to carry all the mud down through the screen and the back-pressure valve so it may pass up outside the screen and casing.

The screen may be of any size or length and made with drill holes only or wire wound to any mesh desired. At the top of the screen is a left-hand nipple 2 or 3 ft. long with the left-hand thread up. By putting the proper tension on the drill pipe and turning, the left-hand thread unscrews and leaves the screen in the hole. The wash pipe is pulled out by the pulling ring.

When the coupling (6 or 8 in.) containing the pulling ring is landed on the elevators at the surface and the joint above unscrewed then the wash-pipe elevators (2 or 2½ in.) may be put on under the top coupling of the string and the wash pipe pulled.

Plugging Top of Screen for Cementing.

A soft wooden plug about 20 in. long is made as shown in Fig. 9. The bottom of the plug is made conical as a guide in entering and the body cylindrical to fit tight into the screen nipple, which has a left-hand thread.

The top is rounded over to guide the swedge nipple that is later placed to fit down over the left-hand thread. A 1¼-in. vent hole is bored through the axis of the plug in order to allow mud to flow back into the drill pipe in setting the plug.

A countersink 6 in. deep is made in the top of the plug so that it may be fitted on the end of the (4-in.) drill pipe. A piece of leather is nailed over the vent hole in the bottom of the countersink so as to make a flap valve.

The plug is then run in on a string of drill pipe to bottom.

I have found by experience that enough loose material will be pushed ahead of the plug to pack efficiently outside the left-hand nipple so that no cement will flow down outside the screen in cementing. Pump pressure is put on the drill pipe, which closes the flap valve in top of the plug. The string is raised and the drill pipe pulls out of the plug, an immediate fall of pressure being shown by the pump gauge, indicating that the plug is left in place.

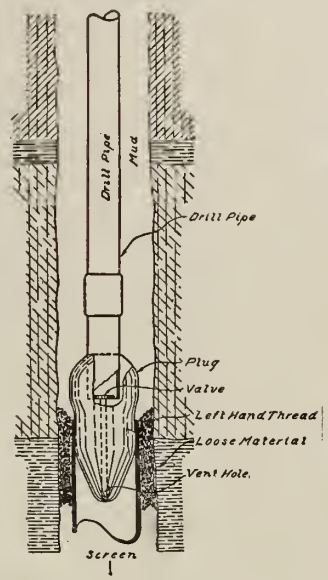


Fig. 9.

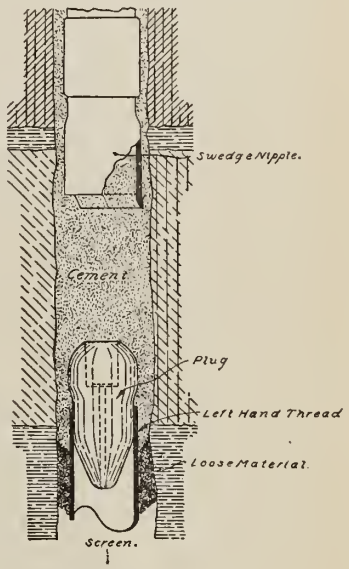


Fig. 10.

The string of pipe is pulled out and the well is then in shape for running in a string of casing and cementing.

Cementing in the Casing Above the Screen.

On this string should be a by-pass nipple, as previously described. Whether a back-pressure valve is to be used or not is determined by the depth and condition of the well. The string (if 8-in.) should have on its bottom end a 9 by 8-in. swedged nipple. The 9-in. end should be cut with an offset and the lip thus formed bellied out slightly as indicated in Fig. 10. The purpose of this lip is to guide the plug and screen in line by turning the casing and to give a "feeling" which will indicate whether the swedge nipple is resting on top of the plug or has slipped down over the left-hand thread as it should. The string is lowered to bottom and marked, then pulled up until the circulation of mud is good.

The cementing operation may be done by the methods already described. After the cement has had time to harden, five days should be plenty, the wooden plugs, brass bars, and back-pressure valve may be drilled out, the inside of the screen washed out with mud down to the wash-pipe plug and the drill pipe then withdrawn. A gate valve should be put on the casing and the well is then ready to bail to test for oil or gas.

Plugging Wells by Cementing.

The two-plug cementing system is well adapted to put in a cement plug in the bottom of a well to exclude water or fill a well any distance with cement mortar. For instance, if it is desired to plug off the bottom 20 ft. of a hole the proceeding would be practically the same as cementing in a casing but no by-pass nipple or back-pressure valve would be used and the drill pipe

would be employed to pass the cement to the bottom of the hole. The bottom plug should be made 36 in. long, but not tapered, and bored full of holes, which are filled with lead so that the plug will stay on the bottom. The operation should be so performed that the bottom plug will shut off the pump when it reaches bottom and not by-pass the cement as before described. The drill pipe should then be pulled back until the bottom plug passes out. About half the cement to be placed should be pumped through, then the drilling pipe should be pulled back proportionately.

The top plug and the sack should be used to push the cement ahead and to prevent mixture with the mud following.

In cementing off 20 ft. a surplus of cement mixture should be put in and the drill pipe pulled back only about 22 ft. from bottom and the mud circulation kept on for half an hour to dissipate the surplus cement.

By this method of building up a cement plug from the bottom there need be no time limit to the completion of the cement-plugging operation, as the drill pipe can be pulled back from time to time and cement kept going in until the hole is completely filled. The drill pipe should have a scavenger plug passed through it about every hour to keep it clear of set cement; the joints as disconnected at the top should be washed clear.

Short plugs should be made of neat cement. Larger ones may be cement-and-sand mixtures.

Difficulty of Getting Reliable Information.

For instance, the catalogue of hydraulic rotary well-drilling machinery of a prominent oil-well supply company has an article on "Cementing Casing in Wells." I quote from it as follows: "Seventh: Force the plug into the well by running in the drill pipe on top of same until the plugs and cement reach the bottom of the hole; water should be run into the hole as the drill pipe is lowered."

This might be practical for shallow strings of casing up to 800 ft. But how about 2,000 ft.? If the drill pipe is stacked in trebles in the derrick it takes quick work to run in 1,000 ft. per hour, so, if it took an hour to mix the cement and get it in the top of the hole and two hours to run the plugs it would take close to three hours to get the cement to the bottom of 2,000 ft. of casing, when it would probably have set some—enough to be too hard to allow of its being forced up outside the casing into place. But why use a drill pipe for such purpose when the cement can be dumped down 2,000 ft. by the mud-pump pressure in 10 min. or less?

Quoting the same catalogue further: "Ninth: When in doubt of the plugs being together, a measuring line should be used for verification."

As a practical matter the length of the drill pipe is known by actual measurements so that the exact location of the plugs should be known when a drill pipe is run in as directed under the seventh item, so what verification is necessary with a measuring line?

Quoting further: "Eleventh: Cement will not set in oil. . . . ."

Dry cement will not set if mixed with oil because there is no water to hydrate it. Cement properly mixed with water and poured into oil will set and harden in the oil, as I know by actual trial.

Water Supply Paper No. 257, U. S. Geological Survey, on Well-Drilling Methods, in describing the hydraulic rotary method under "Drilling Operations," p. 71, says: "Drilling is accomplished by rotating the entire string of casing, on whose lower end is a toothed cutting shoe."

It would be practically impossible to drill a well 1,000 ft. in depth with a toothed cutting shoe on a string of casing in any possible formation. A casing that is to be set either as a water-excluding string or as an oil or gas string is never used to drill with. It is true very pretty pictures have for years past appeared in various well-supply dealers' catalogues showing how wells are drilled with rotary shoes, but as a practical matter wells are never drilled in this way. A rotary shoe is a very useful tool to run in with a joint of casing on a drill pipe to take lumps out of a hole and straighten it preparatory to casing. A rotary toothed cutter is sometimes used in core drilling, but the kind of rock or other material it will work in and produce a core from is very limited.

From "Special Operations," p. 74, I quote: "In penetrating firm material it is sometimes necessary to employ a rotary drill bit instead of a rotary shoe. Two styles of bit for this purpose are in general use—the diamond-shaped and the fishtail. The diamond-shaped is usually first employed, and the fishtail afterward used for reaming or enlarging the hole."

Now, this is all wrong. I will venture to say that 99 per cent. of all rotary drilling is done with a fishtail bit. The Sharp & Hughes bit is used for rotating on hard rock.

But why drill a hole too small and then ream it down? What is gained? As a matter of fact it usually takes longer to ream 100 ft. of hole than it would to drill the same 100 ft. of the full-sized hole at the first operation. Skillful rotary drilling completes the hole to the full size required and "muds up" all at one operation.

Technical Paper No. 32, Bureau of Mines, on Cementing Process of Excluding Water from Oil Wells as Practised in California, gives under "Recommendations and Suggestions," p. 7, the following: "3. The well should be cleared of all debris and mud and enough clear water should be pumped in to wash out any sulphur or alkaline water."

To pump clear water into any well at any time before its completion is a questionable proceeding, even if drilled with the cable tools in a hard formation. In wells drilled in unconsolidated formations with the rotary such action would mean complete destruction of the well. Only after all cementing is done and the well is completed and fully protected by casing or screens is washing with clear water practicable.

Quoting again from the same source: "5. Previous to cementing, some definite information should be gained relative to the action of the water in the hole on the setting qualities of the cement."

I regard it as not to the point to talk about the action of salt, alkaline, sulphur, or gypseous water or oil in the hole, on cement when the neat Portland cement is first hydrated with suitable water, mixed on the surface, and passed with practically no chance of serious contamination to its final place.

Quoting again from the same: "An excess of gypsum in the water might delay the setting of ordinary cement three or four months."

I would be glad to be "shown" on a statement of this kind. Experiments of E. Candlot, an eminent cement expert (Sibley Journal of Engineering, January, 1905), show that when gypsum was ground with cement clinker in the ratio of 1½ parts in 100, which proportion was found to produce the best effect in retarding the set, the maximum time for initial set was

5 hr., and final set 19 hr., and not three or four months.

Technical Paper No. 43, Bureau of Mines, on p. 6, describing a blow-out preventer, says: "The preventer, when used, is always placed on the last string of casing set or landed, thus controlling the flow between that string and the drill pipe or casing that is being lowered." Then, same page, under "Sealing of Artesian Water or Gas Strata" says, "This end can be easily accomplished in drilling with a rotary rig by forcing muddy water to the bottom of the well through one of the lateral openings of the preventer."

Suppose, for instance, the preventer casing was set at 700 ft. and the drill was working at 1,000 ft., leaving 300 ft. of hole open. It would be a practical impossibility to mud the bottom of the hole by pumping muddy water into the top of the well between the casing and drill pipe.

It is an elementary requirement in rotary drilling and mudding to have a mud circulation down the drill pipe, or a casing, and up between this pipe or casing and the walls of the well, if any mudding is to be accomplished.

The wobble of the rotary-drill stem must do the plastering; it cannot be efficiently done in any other way. Under the same head comes a most surprising statement: "The mud can easily be removed by releasing the pressure or bailing down the water in the hole."

But it is not necessary to quote more. The educated engineer that desires some information on well drilling and operating cannot possibly study out how mudding and cementing is really done from such a report. In marked contrast one can find in the Institute Transactions exact, clear, and authoritative information on drilling holes in prospecting for coal, also on mining and preparation of coal for market, furnished by men who have actually performed the work. Unfortunately, petroleum mining has not had like information on drilling wells, and on refining and marketing the oil.

There were over 25,000 wells drilled for oil and gas in the United States east of the Rocky mountains the past year, or a well completed every 21 min. Their average cost was probably between $2,500 and $3,000 each. Between $50,000,000 and $75,000,000 was expended in drilling to keep up the supply of oil and gas.

It is really surprising that no more has been written upon the art of drilling wells and producing oil and gas by men experienced in these matters.

DETERMINATION OF PROPERTIES OF PETROLEUMS

In technical paper No. 74 published by the U. S. Bureau of Mines. Messrs I. C. Allen, W. A. Jacobs, A. S. Crossfield and R. A. Matthews give the following account of methods used in determining the physical and chemical properties of the crude petroleum of the oil fields of California.

Sampling.

The samples were collected at the wells by members of the Bureau of Mines. They were put in 1-gal. tin cans that were soldered tight and shipped at once to the laboratories where the analyses were made. The samples were taken, where possible, by allowing the oil to run from the outflow of the well directly into the sample can; where this method was impracticable a dipper was used. After the can was filled it was soldered tight as soon as possible, to avoid loss of the more volatile constituents of the sample by volatilization. Oil that had been exposed to atmospheric influences for even a short period was not collected. It was believed that collecting fresh oil, quickly sealing the can, and not opening the can until a part of the oil was taken for analysis insured the composition of the sample analyzed being identical with that of the oil that flowed from the well.

Physical and Chemical Examination.

The specific gravity was determined by means of the westphal balance.

The Baume scale for indicating the density of petroleum (in the writers' opinion a most deplorable system and one to be discouraged) is in such common use that for the convenience of those unfamiliar with the specific gravity of oils both the Baume degree and the specific gravity are given.

Flash Point.—As most of the crude oils examined contained at least a trace of water, they showed a marked tendency to froth when heated and gave considerable difficulty with the closed Pensky-Martens flash tester, many frothing over at temperatures much below the flash point of the oil. For this reason, and to obtain comparative tests, it was considered advisable to determine the flash points of all the crude samples in an open Pensky-Martens cup carefully screened from air currents. On account of the frothing of the samples the temperature had to be increased slowly; a rise of 2° to 3° C. per minute was found to give good results. The gas test flame, of the size and form recommended for the Abel tester, was exposed for one second 1 cm. above the surface of the oil, at each rise of 1° C. beginning at 10° below the flash point as determined by a preliminary test.

For accurate testing the Bureau of Mines flash testers which have been developed since these tests were begun are recommended.

Burning Point.—After the flash point had been determined, the heating was continued without interruption, exactly as before, until the "flash" became permanent, that is, until the oil ignited and continued to burn quietly.

The viscosity was determined in an Engler viscosimeter at 20° C.

The calorific value was determined in a Berthelot combustion bomb. (Dinsmore-Atwater model.)

The British thermal units per lb. were calculated by multiplying the calories per gram by 1.8.

Sulphur was determined by carefully washing out with distilled water the contents of the bomb after the combustion, the sulphuric acid being precipitated with barium chloride in the usual manner, and the percentage of sulphur calculated.

Water was most accurately and most conveniently determined during the course of an ordinary fractionation; it distilled over in those fractions having a boiling point between 100° and 150° C. under atmospheric pressure and could be removed readily from the receivers with a micropipette and weighed. Usually a few drops of water adhered to the condenser and failed to run into the receivers; in this event a small pellet of absorbent cotton moistened with water, squeezed as dry as possible and weighed, was fastened to a wire and run up into the condenser to remove these last traces of water. The weight of the drops was determined by the increase in weight of the cotton pellet.

The fractionation, or separation of each oil into its crude commercial components, was made in an electrically heated still, and was conducted as follows:

Two hundred grams of the sample of oil was weighed into a ¼-liter flask. The flask was then connected to a Liebig condenser placed vertically, and the distillates were collected in weighed receiving tubes placed in a Bruehl receiver.

The oil was distilled under atmospheric pressure at increasing temperatures up to 325° C., the receivers being changed at each increment of 25°. The temperature was then allowed to drop to 125° C., to keep the oil from boiling over when the vacuum was used, and the distillation was again continued under a vacuum of 10 to 20 mm. mercury pressure till the temperature within the flask reached 325° C.

Separation and Determination of Paraffin.—Existing methods for the determination of paraffin in crude oils, residues, and fluxes depend almost wholly on the relative solubilities in various solvents of the solid paraffins, the liquid paraffins and unsaturated bodies that occur in petroleum and its products. One of the oldest methods is that of Grotowsky, modified by Engler and Bohm, which depends on the separation of paraffin by its insolubility in a mixture of ethyl alcohol and ether. This method has been improved by Holde and is the one in most common use to-day. Zaloziecki separates paraffin by crystallizing it from a mixture of ethyl and amyl alcohols. The method of Pawlewski and Filemonowicz depends on the insolubility of paraffin in glacial acetic acid; that of Holand on the insolubility of paraffin in absolute alcohol.

None of these methods is applicable to all mixtures containing paraffin. Efforts to improve these methods by previous treatment of the mixture with sulphuric acid or by distillation have not been entirely successful. In Holde's improved method the sample is first distilled down to a coke, and the paraffin is separated from an aliquot part of the distillate by crystallizing it from a mixture of ether and alcohol at a low temperature. If impure, the paraffin is treated with sulphuric acid or is recrystallized from absolute alcohol. This method, though the best one in use at present, gives inaccurate results. It is long and tedious; some paraffin is probably destroyed in the distillation, some is lost in the solutions, some heavy oils may be retained in the precipitate and the maintenance of temperatures as low as —20° C. is attended with difficulties.

Efforts have been made in the Bureau of Mines laboratories to improve these methods, but up to the present time no method of universal application has been found. The following method, still incomplete in detail, is suggested as being of use in some cases:

The sample to be treated is dissolved in petroleum ether, filtered, and the filtrate treated first with concentrated sulphuric acid and then with fuming sulphuric acid. The petroleum ether is then distilled off and the residue dissolved in acetic ether. Ninety-five per cent. alcohol is added and the mixture cooled to 0° C. in ice. The separated paraffin is filtered off, washed with 75 per cent. alcohol, dried, and weighed. Under the above conditions 2.5 mg. of paraffin (melting point 56° to 58° C.) will dissolve in 100 c. c. of the solvent mixture.

Refining.—The oils—napthas, lamp oils, and lubricants—were further refined as follows: Two hundred and fifty grams of the oil was put in a 1-liter separatory funnel and shaken vigorously; that is, 120 to 150 shakes per minute for 15 minutes in a shaking machine, as follows:

Four times with 10 c. c. of concentrated sulphuric acid (or until the oil was not appreciably colored by this acid treatment), once with a 10 per cent. solution of sodium carbonate to remove the free acids, and three or four times with water to remove the last traces of soda, etc. The oil was then dried with Glauber salts and distilled.

This refining acid treatment yielded a water-white, practically odorless product of excellent quality.

Because of their high viscosity, it is advisable to dilute the heavier fractions (those distilled under a vacuum at temperatures above 250° C.) with 1 part of chemically pure benzene before subjecting them to the acid treatment.

Unrefined napthas.—Those fractions that boil at temperatures up to 150° C., under atmospheric pressure, comprise the "unrefined napthas."

Unrefined lamp oils.—Those fractions boiling between 150° and 300° C., under atmospheric pressure, comprise the "unrefined lamp oils."

Unrefined lubricants.—Those fractions boiling between 300° C., under atmospheric pressure, and 325° C., under a vacuum of 10 to 20 mm. mercury pressure, comprise the "unrefined lubricants."

Asphaltum residue.—That part remaining in the flask, undistilled, is termed "asphaltum residue."

In practically all of the oils examined this residue was a jet-black, lustrous mass, that was brittle at room temperatures and had a consistency much like ordinary taffy. It could be chewed, but was very sticky when slightly warmed; on solution in benzene it left no appreciable quantity of carbon flecks. This showed that these asphaltum petroleums, after removal of the oils distillable at temperatures up to 325° C., under a pressure of 10 to 20 mm. of mercury, leave a residue of solid elastic asphaltum usable for commercial purposes.

Refining losses.—The above acid causes a total loss of approximately 11 per cent. in the oil treated. This loss is too high, and should be reduced.

PLANT OF ARMSTRONG, WHITWORTH, OF CANADA.

A very important addition to the steel plants of Canada is that of the crucible steel plant of Armstrong, Whitworth of Canada. The works are located near Montreal, at Longueuil. There is already erected approximately 60,000 square feet of buildings.

There is being installed in these buildings crucible steel furnaces, with all necessary apparatus for making higher grade steels, including high speed steel. The plant provides for the complete handling from raw material to the finished product. A portion of the shop is set apart for the manufacture of twist drills, milling cutters, reamers, taps, shear blades and special small tools, which will be manufactured from high speed steel. In the spring the company expects to install either electric furnaces or converters for making mining drill steel of a very high grade. By dint of many experiments, the investigators have succeeded in fabricating a high grade hollow steel bar for special use in mining drills, which undoubtedly will be a boon to the mining fraternity.

Small intricate steel castings and complicated drop forgings will also be made suitable for the small repair parts of mining machinery.

The plant will be run altogether on Canadian lines, with every endeavor to suit the requirements of the Canadian consumer.

THE ORIGIN OF PETROLEUM*

By Dr. Hans Von Hofer, Vienna, Austria, Translated by R. W. Raymond, New York, N. Y.

Apart from the hypothesis of a cosmic origin (which failed of acceptance because it was not adequately supported by facts), the only important controversy concerning the origin of petroleum has been, for a long time, between the advocates of inorganic and of organic origin respectively. Each of these theories has had a long history of development, and is still being perfected, under the influence of two causes: (1) the increasingly extensive and thorough study of the oil-fields (of which new examples are periodically discovered and opened); and (2) the progress of synthetic experiments devoted to this question. Moreover, the advance in our physical and chemical knowledge of the properties of this peculiar natural product has necessarily modified all criticism of conflicting views.

1. The Hypothesis of Inorganic Origin.

That the notion of an inorganic origin of petroleum, first set forth by Berthelot in 1866, and afterward ingeniously developed and formulated by Mendelejeff, should thus have proceeded chiefly from chemists, is quite natural; for the question was one of possible chemical processes in the earth's interior, and of imagined chemical reactions to be verified by experiment. Hypotheses of this kind were suggested by many chemists, of whom two, P. Sabatier and J. H. Senderens, may be specially named by reason of their highly interesting chemical experiments.

Among geologists, Mendelejeff's hypothesis was received at first with much interest and favor; for it rested on the assumption of a central terrestrial mass of iron carbide, and the geologists had good reasons for adopting that assumption. Yet comparatively few of them attempted to furnish geological proofs of the hypothesis: the majority either silently believed in it, or for one or another reason rejected it altogether.

An apparently weighty support of Mendelejeff's view was furnished by the American, G. F. Becker, who found in the oil-regions of the United States important and abnormal disturbances of the isogons of terrestrial magnetism, and inferred that in these regions the central iron mass must come nearer to the surface than elsewhere. To my mind, the better explanation is, that in these oil-fields great quantities of magnetic iron have been placed. All iron pipes, especially when set vertically and hammered, notoriously become magnetic; and this is the case with the tubings of the oil-wells—sometimes to such a degree that iron screws, lowered by ropes into the bore-holes, are so strongly attracted by the iron linings that they stick fast, and will not descend further. Moreover, the disturbances of the isogons are not uniform—a circumstance easily explained by the varying amount of iron tubes. Finally, violent irregularity of these curves is shown in places where deposits, either of oil or of magnetite, are not known.

Mr. Becker's conclusions were disputed by W. A. Tarr for other reasons.

The most zealous advocate in America of the inorganic origin of petroleum, so far as I know, is Eugene Coste, of Calgary, who has collected with praiseworthy industry all the facts which support this hypothesis. To give to his many arguments the serious, thorough, and critical examination which they deserve, is the principal purpose of the present paper, as will be seen further on.

During recent decades, no European geologist of authority has advocated the inorganic origin of the petroleum occurring in large deposits.

II. The Hypothesis of Organic Origin.

As regards organic origin, the view may first be mentioned, that petroleum is the product of distillation from coal—from which, in fact, artificial distillation had obtained photogene and other products having considerable physical resemblance to kerosene. This view was first expressed in Europe by F. von Beroldingen (1778). Von Kobell, Anstedt, Leon Malo, Romanowsky, Noeggerath, Huguenet, v. Hochstetter and others accepted the hypothesis; but the proofs adduced by v. Beroldingen were soon recognized as inadequate. Since petroleum often occurs not underlain by coal-beds—occurrences of coal and oil being, in fact, usually (as on the northern border of the Carpathians) mutually exclusive;—and since, moreover, the distillation-products of coal are entirely different from petroleum chemically (as Baron Reichenbach proved, as early as 1833), this hypothesis had to be abandoned. So far as I know, it received no support in America, because in Pennsylvania, the mother-land of the oil-industry, there were no coal-beds under the deposits of oil.

Animal Origin.

Hypotheses of an organic origin were thus narrowed to the direct transformation of animals or plants to petroleum. Already in 1794, Haquet suspected that the oil of Galicia came from marine mussels, "dissolved" in salt water. L. v. Buch, Quenstedt, Volger, Naumann, Dufrenoy, Posepny, Verbeck, Fennema, and many other eminent geologists, accepted this hypothesis, mostly in view of the circumstance that the bituminous rocks carry the fossil remains of animals. Bertils found in the Kuban district of southern Russia, in a bunch of mussel-shells, a substance partly "petroleous," partly animal remains still undecomposed. R. A. Townsend reported a similar observation from the Tertiary oyster-banks of Assam, in Asia. Ch. Knab somewhat extended the hypothesis; and in North America it found in Whitney, for the petroleum of California, and the brilliant Sterry Hunt, for the oil-deposits in the ancient limestones of Canada, Pennsylvania, and Ohio, its most influential advocates, with whom others allied themselves.

When, in 1876, I visited the oil-fields then under exploitation in the eastern United States and Canada, the question of the genesis of these deposits received my earnest attention. I adopted the hypothesis of their animal origin, and in my report of this journey, entitled, Die Petroleum-industrie Nordamerikas, I briefly argued in its favor. Since that report was the first account given in the German language of the geological, technical, and commercial features of this interesting and economically important field, the hypothesis of animal origin (as well as the theory of anticlinals, advocated by me) was tested by observations in the European oil-fields, and, confirmed by geologists such as Tietze, Paul, Uhlig, O. Fraas, v. Gumbel, H. Credner, C. Zinken, and many others, it continued to win more and more advocates.

*Extracts from a paper presented at the New York meeting, A.I.M.E., February, 1914.

In 1888 appeared my book, Das Erdol und seine Verwandten, in which I examined critically all the genetic hypotheses known to me, and not only demonstrated that of animal origin, but pointed out certain important factors in the process of transformation, particularly the comparatively low temperature and high pressure, as indicated by geological evidence. An important landmark in genetic hypothesis was thus established, furnishing for the guidance of synthetic experiments two important conditions of the transformation of animal bodies into petroleum.

A few weeks later, C. Engler, of Karlsruhe, tested my thesis experimentally, by heating in retorts, under a pressure of 10 atmospheres, and to a temperature of from 300° to 400° C., first fish-oil, and afterward fishes and mussels. He obtained in this way a product very like petroleum, from which he isolated several members of the methane series. My hypothesis, thus further corroborated, became a theory, known as the Engler-Hofer theory, since both of us had equally contributed to its establishment. It won the support of chemists as well as geologists—whose numerous names it is not necessary to catalogue here.

It is noteworthy that the geologist and the chemist must co-operate in the solution of genetic problems in geology—the former by investigating the natural conditions attending a given formation, while the latter synthetically performs the process itself. Only when thus confirmed is the theory adequately established.

Vegetable Origin.

A great additional service rendered by C. Engler was his tireless labor through many years in the investigation of the various transformations undergone, up to the present time, by the original materials and primary forms of petroleum—a labor which still further perfected the Engler-Hofer theory. These investigations showed that vegetable fats also, by dry distillation under high pressure and at comparatively low temperature, could be transformed into petroleum, as American chemists (Warren and Stoner, Sadtler, etc.) had already proved. Our theory could therefore be extended to include those plants which, like animals, contain fats and albumens, but no cellulose—namely, the microscopically small diatoms. T. Fegraus and A. F. Stahl, who first pointed out this source of petroleum, were followed by G. Kramer and A. Spilker, and, still later, by Potonie. This hypothesis is applicable only where, as in California, the minute and delicate siliceous shells of these fossil algae occur in connection with oil-deposits.

Many American geologists and chemists like Lesley, Newberry, Ashburner, Shaler, Orton, Peckham, Mabery, etc., had already either advocated a common animal and vegetable origin, or (like the two highly esteemed investigators last named) assigned an animal origin to the nitrogenous California product, and a vegetable one to the non-nitrogenous oil of Pennsylvania. The contrary appears, however, to be the truth, since the diatoms are found in California, and not in Pennsylvanian, oil-fields. Probably the advocates of the double origin were not thinking of these microscopic vegetable forms at all; they speak in a general way of "plants." But the more highly organized plants contain cellulose, which would leave after distillation a carbonaceous residuum, such as is not found in petroleum and its deposits. For this reason, the above hypothesis, once so generally favored, could not be finally accepted.

According to our present knowledge, the original material of petroleum is principally fat, and subordinately wax, resin and albumen. These substances, especially fat and albumen, occur chiefly in both the lower and the higher animal organisms. Petroleum, therefore, is mainly of animal origin, though it may have been formed, here or there, from fatty plants, particularly diatoms.

STANDARD OIL

According to the Boston News Bureau, of the 34 Standard Oil companies 11 are transportation companies, four are producers, 19 are refiners and marketers. Of the latter, five are marketing concerns exclusively, three do a refining business only, and 11 are both refiners and marketers. The leading companies engage in both refining and marketing. In this class are Standard Oil Co. of New Jersey, the former parent concern, with its capital of close to $100,000,000, and Standard of New York, which last year raised its capital to $75,000,000. Standard Oil of California, another of the heavier capitalized companies, is a refiner and marketer. The latter now has a capitalization of $50,000,000, but stockholders have been asked to approve an increase to $100,000,000. The refining and marketing companies have been a great melon patch in the past two years. In only one company outside of this group have shareholders been given a bonus in stock distribution. This was South Penn Oil Co., a producer. At dissolution the 19 companies in the refining-marketing group had a combined capital of $168,188,382; now it is $321,788,382, an increase of $153,600,000. The first startling melon-cutting came when Standard Oil Co. of Indiana announced its 2900 per cent. stock dividend. Of the 19 companies of this group, 13 have made capital increases resulting in bonuses to stockholders. Following is a list of companies in this group, with their capital at the dissolution, present capital, and disposition of new stock:

	Capital at dissolution.	Present capital.	Method of distribution.
Anglo-American	$5,000,000	$10,000,000	100% Div.
Atlantic Refining	5,000,000	5,000,000	....
Borne-Scrymser	200,000	200,000	....
Chesebrough Mfg.	500,000	500,000	....
Colonial Oil	250,000	250,000	....
Continental Oil	300,000	3,000,000	900% Div.
Galena-Signal com.	8,000,000	12,000,000	50% Div.
Galena-Signal pfd.	2,000,000	2,000,000	....
Solar Refining	500,000	2,000,000	300% Div.
Standard Oil N. J.	98,338,382	98,338,382	....
Standard Oil Cal.	25,000,000	50,000,000	Subscription
Standard Oil Ind.	1,000,000	30,000,000	2,900% Div.
Standard Oil Kans.	1,000,000	2,000,000	100% Div.
Standard Oil Ky.	1,000,000	3,000,000	200% Div.
Standard Oil Neb.	600,000	1,000,000	*Div.
Standard Oil N. Y.	15,000,000	75,000,000	400% Div.
Standard Oil Ohio	3,500,000	3,500,000	....
Swan & Finch	100,000	500,000	Subscription
Continental Oil	300,000	3,000,000	300% Div.
Vacuum Oil	2,500,000	15,000,000	Subscription
Waters-Pierce	400,000		
(now Pierce Oil)		10,500,000	2,625% Div.
Total	168,188,382	321,788,382	

*Capital first increased from $600,000 to $800,000 with 33 1-3% dividend, then to $1,000,000 with 25% dividend.

Cash dividends paid by refining-marketing companies for two years ended Dec. 31, 1913, aggregated over $111,000,000. In 1912 about $30,000,000 was distributed, and in 1913 more than $81,000,000. In the last year, however, almost $40,000,000 came from special dividend by the New Jersey company representing liquidation of loans by former subsidiaries.

The largest dividend payer is Standard of New Jersey, with regular annual payments of close to $30,00,000. Next comes Standard of Indiana, which last year paid $9,600,000. New York is now the third largest dividend payer at $6,000,000 annually. Standard of California is now distributing $5,000,000 yearly.

Actual earnings as reported by eight companies, together with indicated profits of three companies, and adding dividend payments of six companies, gives a total of over $59,000,000. This does not include earnings of the New Jersey company, estimated in some quarters at $40,000,000 annually. Giving New Jersey credit for $30,000,000 brings the total to $89,000,000, exclusive of the New Jersey company's earnings from liquidation of loans.

Refineries represent an enormous investment. Just how much, it is impossible to say, for the companies which publish balance sheets make no distinction between refineries and other property, and some companies, including Standard of New Jersey, do not issue a balance sheet.

Standard of New Jersey owns six refining plants with total capacity of over 125,000 barrels of crude oil a day. Standard of California has three big refineries with total daily capacity of 95,000 barrels.

Standard Oil of Indiana has had to increase refining facilities greatly, owing to rapidly growing business in its territory and the introduction of motor spirits, a substitute for gasoline. It has had to spend several millions in installing the new refining process.

Atlantic Refining Co. is one of the biggest refiners, having three plants with about 64,000 barrels daily capacity. Galena Signal Oil Co. which supplies 98 per cent. of the railroads and 75 per cent. of the street railways with lubricating oils, owns six refining plants, with annual output of 800,000 barrels of special oils.

Standard Oil of New York has four plants with total capacity of about 22,000 barrels daily. Most of this oil goes to New York and New England. The company obtains its requirements for its Far East business from Standard Oil of California.

Vacuum Oil has three big refineries in the United States, and two in Austria and Hungary.

Standard Oil of Kansas has come to the front as a big refiner. In 1913 it constructed 52 new stills at its Neodosha, Kans., refinery, increasing the number to 65. It sells a large part of output to other Standard companies, principally the Indiana.

Standard Oil of Ohio has a plant at Cleveland with a capacity of about 2,000,000 barrels yearly. This is said to be the most complete for refining of gasolene in the United States, and turns out about 35,000 gallons daily.

Solar Refining Co. has a plant at Lima, Ohio, with 10,000 barrels daily output, distributed in Ohio, Kentucky, Indiana and Michigan.

Pierce Oil Corporation (formerly Waters-Pierce) which broke away from its Standard affiliations, has five refineries with capacity of about 35,000 barrels daily. One is at Tampico and one at Vera Cruz.

Standard Oil's market is the world. The 34 companies have distributing stations in every part of the United States and Canada, and throughout Europe, as well as in Asia, Africa, Australia and South America.

THE ILLINOIS OIL FIELDS*

By H. A. Wheeler.

Illinois has so recently attained the third place in the oil production of the United States that few realize its great importance, or are aware of its highly profitable character. Since 1907 Illinois has furnished about 15 per cent. of the United States output and about 10 per cent. of the world's production. The value of the output in 1913 is estimated at $30,000,000, of which about $20,000,000 is profit.

The present prosperity dates from 1905, but efforts have been made since 1865 to develop production and geologists have been very sanguine as to its future for over 25 years. Had the oil operators been as confident as the geologists, the field would have been opened at least 30 years earlier. For the rich Eastern Illinois oil field is located along the La Salle anticline, that was mapped 46 years ago by Professor Worthen in the first geological survey of the State. Prof. T. B. Comstock enthusiastically wrote in 1887 about the highly promising character of this anticline, to which he again called attention in 1889.

The writer's studies in 1888 were convincing as to its oil future, yet to have then advocated drilling would have earned the reputation of being a dreamer. In fact, as late as 1903 the writer's suggestion to a prominent Pittsburg oil operator to prospect in Illinois met with contempt and derision, which was representative of the general feeling then held by the oil fraternity, yet this same party made a large fortune four years later out of a block of Illinois oil leases.

The first commercial wells were brought in at Litchfield, 50 miles northeast of St. Louis, where in 1882, in drilling for coal, gas was discovered that supplied the town several years. Later, some oil wells were brought in that until 1902 produced a lubricating oil that sold for $5 a barrel.

In 1887, at Sparta, 40 miles southeast of St. Louis, in drilling for water, gas was discovered that supplied the town about 20 years, and in 1906 several oil wells were brought in half a mile northeast of the gas wells.

In 1890, in drilling for water, gas was discovered near Pittsfield, in Pike county, that later developed into a field over 10 miles long.

The present highly prosperous era dates from 1904, when a small gas well was drilled near Casey, in Clark county, by J. J. Hoblitzell, who was induced to prospect at Oilfield on the showing of oil and gas made by some old wells that had been drilled in 1865 by Chicago parties. The latter drilled several wells on the evidence of oil and gas seepages, but, although a little was found, the wells were a failure from not casing off the water; i. e., they were drowned out. Several more small wells were brought in, but they were so discouraging that they failed to interest the scouts that flocked in when leases were only $5 to $10 an acre. When a 40-barrel well was subsequently brought in, the "talent" promptly scurried after leases, which rapidly advanced to $100 to $200 an acre, and since then the Eastern Illinois field has rapidly developed along the La Salle anticline. The southern extension was discovered in February, 1906, in Crawford county and by midsummer the adjoining Lawrence county began producing. The Allendale pool, at the south end, was discovered in September, 1912. Shipments by tank cars started in June, 1905, and within a year the first pipe line reached the field, followed by four others that had a daily capacity of 112,000 barrels by 1909.

*Extract from a paper presented at the New York meeting, A.I.M.E., February, 1914.

On the western side of the State, the Butler oil and gas was discovered in 1907, the Centralia pool in 1908, the Greenville, Carlinville, and Sandoval pools in 1909, and the Carlyle pool in 1911.

The total production to Jan. 1, 1914, is 209,018,914 barrels, valued at $156,025,398. This record for output and values has never been equalled by such a young field, as it requires time, as well as capital, to develop a new field, especially where there was such a lack of confidence. While the latter has disappeared since 1906 on the eastern side of the basin, it still holds as regards the western side of the basin.

MINING AS A PROFESSION*

By Hennen Jennings.

To consider man without the earliest primitive contributions of the miner and metallurgist takes us back to savagery. Man's greatest endowment is his wonderful and crafty brain cells with their latent powers of development, which has shown him the necessity of supplementing his own strength by outside aids, and then gradually and persistently obtaining the materials for his needs and fashioning them into tools of power, and finally incorporating and making them a veritable part of his being. His first great advances were the commanding of fire, the use of stone implements, then wooden bow and arrow. By these he worked himself into the stone age, but was still brutal, weak, and with little historical recording power. It was not until he delved below the surface of the earth for materials that he was able to fashion the sword, spear, fire arms, protective armor, plow, hoe, pruning-hook, scythe, pitchfork, tires, axe, saw, plane, etc. It was only with metal tools that great agricultural development began, and it only reached its present magnitude when further supported by the metals in the form of railroads, steam vessels, harvesting machinery, etc. Mining and agriculture are the only basic productive pursuits of man, and they are both fostered each by the other, and both dependent on mother earth. The one skims her surface, the other goes deeper. Agriculture furnishes man with food for existence, but mining gives him the materials for power, art and civilization. Without metals the scientists' tools for experimentation and determination would not be possible, nor the diffusion of knowledge and thought by means of the printing press, photographic appliances, telegraph, cable, and the telephone.

The mining engineer must have some sound general knowledge of all other branches of engineering inasmuch as in the equipment and running of great mines and metallurgical plants he must make use of the training of engineers in almost all the other branches, and to obtain from them their best and hold their respect it is necessary for him to at least appreciate the foundations of their specialties to intelligently confer with them and decide upon merits rather than dicta. In addition, he must have special knowledge and training in all pertaining to the discovery, working and valuation of ore deposits. He must have also sound business experience and judgment to gauge the payability of new ventures, and this in turn requires that he should have had in some period of his career a successful experience of management, requiring a knowledge of accounts and faculty of handling men. In distant lands he must have general information of many kinds, and linguistic attainment. The legitimate uncertainties of mining throw peculiar temptations in his path, as these can be twisted to excuse failures of indolence and unfitness, and also be used as narcotics to conscience when temptation to dishonesty presents itself. His work, especially in metalliferous mining, is often far afield from the observances and guidance of owners or directors, and his work is not of a character that erects lasting monuments or stimulates either admiration or criticism. Thus character, industry and tact are even greater requisites for true success than brilliancy of intellect. Mining as a profession requires varied knowledge and gives scope for ability and character, and is a profession befitting the true gentleman as well as the adventurous strong man. It affords absorbing and interesting work, and, being basic and productive, extends opportunity for clean money prizes. Each branch of engineering is based upon metallic foundations; each is dependent upon the other, and none could have reached its present magnitude without the others, but the miner gives to all the other branches the materials that knit them together in common bond of usefulness, making them effective in the art of "Directing the great sources of power in nature for the use and convenience of man."

*Abstract of a speech delivered at the fiftieth anniversary of the School of Mines, Columbia University, May 29, 1914.

THE INTERNATIONAL NICKEL COMPANY.

The Canadian Copper Co., the largest producer of nickel in the Sudbury district, is controlled by the International Nickel Co. The Sudbury mines are the chief source of the world's nickel, and their successful operation is reflected in the recently issued report of the controlling company. Comparatively few shares are owned by Canadians; but the operation of the mines and smelter in Canada makes the industry a very important one, and it is fortunate that it is in a prosperous condition.

The report of the International Nickel Co. for the year ending March 31, shows a profit of $4,792,664.75. Earnings of all properties, after deducting manufacturing and selling expense and ordinary repairs and maintenance, totalled $6,452,758.01. Other income amounted to $114,028.55. Administrative and head office expense, $376,665.27. Corporation and capital stock taxes $61,146.71. There was deducted for depreciation of plant $636,915.20, and for mineral exhaustion $687,394.63.

The capital stock of the company is: Preferred $8,912,600, and common $38,031,500. All but $706.25 preferred and $1,781.25 common is issued. There was paid in dividends during the year: preferred $534,756, and common $3,803,150.

The profits are computed on the sales actually made to customers, and all inventories are taken at cost. All purchases of materials, supplies, etc., are paid for in cash.

President Monell reports that owing to the unsatisfactory conditions obtaining in the steel industry, and a lower price for copper sold, the earnings were slightly less than in the previous year.

Of the stock allotted to employees on Jan. 2nd, about 92 per cent. was taken.

The directors of the company are: R. M. Thompson, A. Monell, E. F. Wood, J. R. DeLamar, W. N. Cromwell, A. Jarctzki, D. Coulson, B. Strong, Jr., S. H. P. Bell, E. C. Converse, W. T. Graham, W. H. Brownson, S. Prosser, W. A. Bostwick and J. L. Ashley.

HAMMER DRILLS VS. RECIPROCATING DRILLS

By P. B. McDonald.

The term "hammer-drill" was formerly applied only to those unmounted air-feed drills better known as "stopers," which have so revolutionized over-hand stoping and raising, since they require practically no rigging-up and can be carried around and operated by one man. Next, the hammer principle found favor for "hand sinkers" in little plug-drill types, some of which require to be rotated by hand, but others being automatically rotated. Almost simultaneously a hammer drill of mounted, screw-feed type, for drifting, began to attract attention. In this type the "water" principle and hollow drill steel is used.

A hammer-drill is one in which the drill-steel does not reciprocate. It is stationary, except for feeding ahead, while it is pounded by the action of the piston. This is in contrast to the older types of drills in which the drill-steel, tightly gripped in the chuck, reciprocates back and forth in "slugger" fashion. The new, screw-feed, hammer type of drill, mounted on bar or column for drifting, looks peculiar when in operation to a miner accustomed only to reciprocating drills, as the parts seem unnaturally still. The principle is exactly like hand drilling with "hammer-and-drill," since in that case also the drill-steel is stationary. On the other hand the "reciprocating" type of power drill is similar to "jumper" drilling, in which two men work a long drill-steel, perhaps 20 ft. long, up and down in a deep hole, usually in soft formations.

The success of the mounted, screw-feed hammer drill for drifting has been partially due to the "water" principle. A stream of water and compressed air is forced through the hollow drill steel to wash the rock chippings from the hole and to lay the dust. The success of the Leyner-Ingersoll drill, particularly in hard-rock has been noteworthy, good results being obtained in the Lake Superior Copper Country, the Black Hills, Colorado, and on the Rand. It is understood that other drill manufacturers will use the hammer principle for drifting drills, and that more of that type will be put on the market. Since it is likely that the type has come to stay, it is worth while to compare it with the ordinary reciprocating drill, as to advantages and disadvantages.

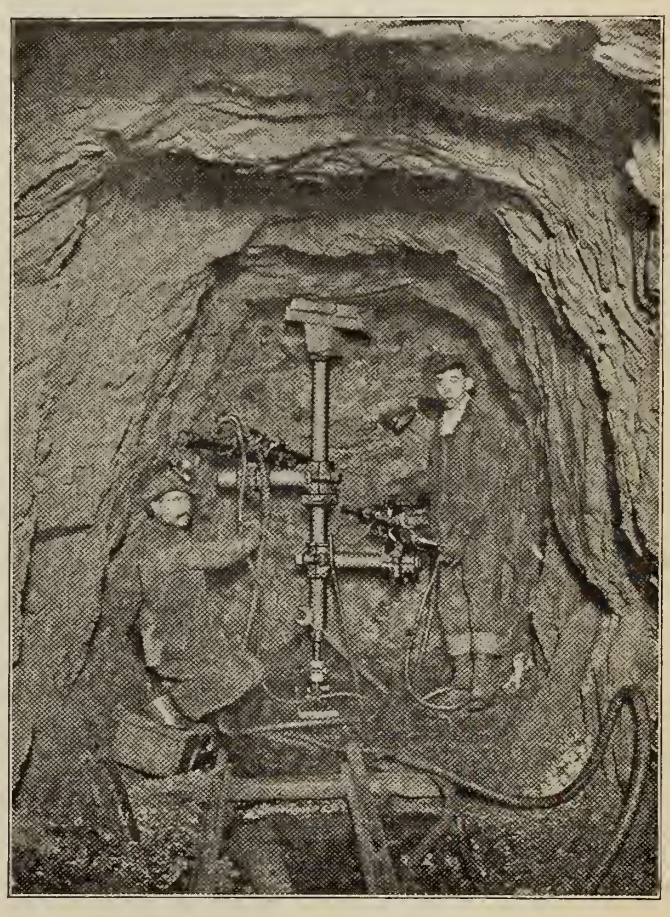
In a competitive test recently conducted in a mine in the Lake Superior district, in medium ore, the Leyner-Ingersoll and a reciprocating drill did as follows:

Leyner-Ingersoll drilled 7 holes, total depth 29 ft. 9 in., in net drilling time of 23 1-2 min., requiring 15 changes of steel taking 12 min. The time consumed shifting the machine to new set-up was 23 1-2 min.

The reciprcoating drill, in the same ground, drilled 7 holes, total depth 27 ft. 6 in., in net drilling time of 25 min., requiring 20 changes of steel taking 13 1-2 min. The time consumed in shifting the machine to new set-up was 31 1-2 min.

Average drilling speed per minute (net drilling time) with the L.-I. was	15.19 in.
Average drilling speed per minute (net drilling time) with the Recip. Drill was..	12.69 in
Average drilling speed per minute (total lapsed time) with the L.-I. was	6.33 in.
Average drilling speed per minute (total lapsed time) with the Recip. Drill was	4.71 in.

While this was by no means a thorough test extending over a long period of time, it is a typical case, and goes to show some of the advantages of the hammer principle. The Leyner-Ingersoll only drilled a trifle faster in net drilling time than the reciprocating drill, but it gained considerably over the other in time of changing drills, making new set-ups and in depths of holes. The incidental operations of changing steel, setting-up, etc., have been proven to take up an average of 50 to 60 per cent. of a miner's time, and are therefore fully as important as the net time spent in drilling.



Drifting with mounted Hammer Drills, Homestake Mine

Drill steel can be changed more quickly with a hammer machine than with a reciprocating machine because the steel rests loosely in the chuck and does not require the careful tightening which a reciprocating drill chuck does. The time spent changing drills may seem only a small detail; but notice in the above records that half as much time was consumed in doing that as in net drilling time, so that for 2 hours of actual drilling as much as one hour might be spent in changing steel. It is wise to economize on such an important detail.

The mounted, screw-feed, hammer drill can be set-up, adjusted to the correct distance from the face of the rock, and the holes pointed advantageously, with greater facility than a reciprocating drill, because the stroke of the machine is taken care of in the cylinder and does not affect the drill steel or chuck. It helps to save time in several of these auxiliary operations. In starting a new hole with a reciprocating drill, especial-

ly a "cutting-in" hole at a glancing angle to the face of the rock, the air can only be turned on half-force for a few minutes or the blows would slide off the rock. As a hammer drill uses many light blows in place of a smaller number of heavy blows, the holes can be started with more precision, and inequalities on the surface of the rock are not so likely to deviate the drill.

There can be little doubt that a hammer type drill is theoretically a more efficient and scientific machine for cutting a hole than is a reciprocating type. In the latter type power is consumed in overcoming friction and inertia of the drill-steel. This in a six-foot length of hole may be a considerable item, due to the drill steel rubbing against the sides of the hole as it is reciprocated and turned. In the hammer type the only weight moved is the hammer alone, which imparts all its energy through the drill-steel to cut the rock. More practical, if smaller, considerations are that the miner's helper is not liable to have his knuckles barked by a reciprocating and rotating chuck, and the miner can feed the machine ahead until the chuck fairly touches the rock, whereas with a reciprocating drill, he would probably stop it an inch from the limit of the feed, due to not being able to distinguish the whereabouts of the swiftly moving chuck. There are small points, but it is on record that miners have refused to use a certain make of machine because the crank-handle was not rounded, but was so sharp-ended as to hurt the hand of the man who turned it.

The hammer types have some disadvantages. In the earlier makes difficulty was experienced in keeping the cutting of the drill-steel close against the rock, so that the full force of the blows was sometimes lost. The latter types, more carefully made, have improvements which obviate this.

In a hammer drill, the drill-steel may be struck over a thousand blows per minute. From 10 to 15 per cent. of these blows may be struck when the bit does not touch the bottom of the hole, because a piece of hard steel cannot be hammered and pressed against rock without bouncing back. The troubles of broken drill-steel are due partially to this, but are not serious with good steel.

Also there are some varieties of rock, clayey or sticky, which drill better with a drill steel churning and plunging in the muddy chippings, which refuse to wash away, than with the hammer drill. The reciprocating drill splashes the hole clean, better than the hammer type, in such rock.

As to the advantages of the "stoper" hammer drills or of the hand sinkers, such as the Jackhamer, little need be said. It is pretty well accepted that the one-man stoper drill has revolutionized over-hand stoping and raising all over the world. In many mining districts, as on the Marquette Range, Michigan, an enormous number of stopers are in use. In a few districts, such as the Birmingham iron mines, Alabama, they were tried and not liked. The little hand sinkers have risen suddenly to fame for down-holes, especially since automatic rotation types came out. For shaft-sinking they are time-savers, as much for the facility with which they can be taken out of the way at blasting time as on account of the much greater number of machines which can be operated in the confined space.

CHAMBERS-FERLAND.

Cobalt, June 10.

The adjourned meeting of the Chambers-Ferland Mining Company was held to-day at the mine office of the company in Cobalt, and after one of the hottest meetings ever held by a Cobalt mining company, a further adjournment was made to the Salisbury House in London, England, July 1. The bone of contention was a proposed by-law for the transfer of the entire stock and assets of the Chambers-Ferland Mining Company for 115,000 $5 shares in the Aladdin Mining Co., the assets of which, so far as can be learned by Chambers-Ferland stockholders, consist of a lease on the Silver Queen mine and a small amount of cash in the bank, while the assets of the Chambers-Ferland represent liquid assets to the value of $150,000, consisting of mine plant, ore on hand, cash in the bank and 124 acres of mining property and ground rents, totalling $6,000 per year. At the meeting Mr. Alfred A. Ames, of Toronto and Haileybury, representing the minority stockholders, strenuously objected to the by-law as being unfair to Chambers-Ferland stockholders. The only ones to oppose the by-law at the meeting were Mr. Ames and Mr. Henry Cecil, the latter representing himself and a number of stockholders. Mr. C. Jorgenson, Mr. Sedgwick of London, England, and associates hold three-fourths of the Aladdin stock, and had a great preponderance of the voting power at the meeting, but in spite of that fact the by-law was not passed. It will come up for discussion at the adjourned meeting in London. Only two directors of the Chambers-Ferland were present, Mr. Robert Shillington, M.L.A., of Haileybury, and Mr. C. A. Richardson, of Toronto. Mr. Alex. Fasken of Toronto acted as secretary of the Chambers-Ferland. The meeting after adjournment for lunch was attended only by the directors and employees of the company and the mine employees, and lasted only about fifteen minutes. The directors for the year were elected, with Mr. C. Jorgenson president, and Messrs. Herbert and Gould of London, Eng., and C. A. Richardson of Toronto. The latter is the only Canadian on the board. One of the features of the meeting was the serving of a writ upon the company by Mr. Henry Cecil to restrain the company from closing the deal with the Aladdin Company for the Chambers-Ferland assets. The minority stockholders are also preparing to take separate action, and will make an application to the courts to force the Aladdin directors to show officially the assets behind the Aladdin stock.

The Chambers-Ferland is an Ontario company, and the proposition of the majority interest to hold the next meeting in London will be also subjected to review by the courts. It is said that the Chambers-Ferland shareholders may receive a cash offer for their holdings.

MOTOR SPIRITS.

The great consumption of gasolene for motor purposes has caused a tremendous increase in the production of crude oil. Products other than gasolene have consequently been produced in excess of the demand. Motor spirits can be extracted from the surplus left after the refining of gasolene, but owing to its disagreeable odor it is not used in automobiles. It is cheaper than gasolene and can be used to advantage where the odor is not very objectionable.

A dividend of 3 per cent. has been declared on the stock of the Beaver Mines, payable July 20 to shareholders of record July 2nd.

NATURAL RESOURCES OF CANADA*

By F. D. Adams

It is in many ways an exhilarating experience, that of living in a new country and in a time of rapid development. We, the Canadian people, have entered into a great heritage—half a continent—standing midway between two of the most densely populated areas of the earth, Europe and Eastern Asia, and having to the south one of the most progressive nations of the world. We are blessed with a most liberal form of government and have ample room for expansion, and are thus free from the many limitations which beset the densely crowded peoples of other countries. We are also free from the ever-present danger of war and invasion which, like the sword of Damocles, hangs over the head of every nation of the older world. This gives a sense of security which is never felt in the countries across the seas. We have, moreover, the advantage of the protection of a great Empire while bearing less than our proper share of its burden.

The population which is rapidly flowing into the Dominion is furthermore of a relatively high quality. Of the 384,867 immigrants who came to Canada in the year 1913, 65 per cent. were from Great Britain and Ireland or from the United States, and consequently spoke the English language as their native tongue, while of the immigrants entering the United States a relatively much larger percentage come from Southern Europe.

Canada is often referred to as being in her "constructive period." The United States is somewhat more advanced in its material development, having now nearly completed its "constructive period." Its chief lines of railway were built some years ago; its free lands are taken up and the country is settled. The crops, once largely exported, are now for the most part required to feed its own people. Canada may read its own immediate future by studying the present situation in the United States—a generation ago her West was as ours is now.

We find, however, that in the great republic to the south a very strong note of warning is already being sounded in respect to its future. This took form in an address delivered by President Roosevelt to the Society of American Foresters in 1903. In September, 1906, Mr. James J. Hill delivered an address which presented for the first time in popular form, under the title of "The Future of the United States," a remarkable collection of economic facts. Let me give a brief summary of its contents:

The supply of coal and iron, a prime factor in the nation's industry and commerce, was being exhausted at a rate which made it certain that before the end of the century the most important manufacturers would be handicapped by a higher cost of production. The supply of merchantable timber was disappearing at a much more rapid rate. But far more serious than all other forms of wastage was the reckless destruction of the natural fertility of the soil. Within a period for which the present generation was bound to provide, the United States would be hard pressed to feed its own people. Mr. Hill told his hearers that the danger which threatened the future food supply of the nation could be averted only by the intelligence and industry of those who cultivated the farm lands, and that they had it in their power to provide a perfectly practicable and adequate remedy by applying the discoveries of physical science to the business of farming.

Many other leading men of the United States, among whom Mr. Gifford Pinchet must be especially mentioned, became impressed with the importance of these great questions, and in May, 1908, President Roosevelt called at the White House in Washington a conference of the governors of all the States in the Union, members of the Cabinet, justices of the Supreme Court, together with the heads of the great scientific bureaus of Washington and other leading citizens, to consider the question of "the conservation of our natural resources." stating that in his opinion this was "the weightiest problem now before the nation." The importance which was attached to this conference was marked by the fact that, for the first time in the history of the nation, the governors of all the States were assembled to consider a great national question. This led to the appointment of a National Commission of Conservation.

Following this the Governments of Canada, Newfoundland and Mexico were invited to join with the government of the United States in appointing representatives to a North American conference to meet in Washington in February, 1909. Upon the receipt of the report of the Canadian representatives our Government decided to appoint a permanent Commission of Conservation in Canada, which has been actively at work since that time under the able chairmanship of Mr. Clifford Sifton.

If the conservation of their natural resources is a question of such importance in the United States, it is of equal, if not of greater importance here in the Dominion of Canada; it is of the greatest moment for the future of Canada that the leaders of our national thought and through them all the citizens of our Dominion should be seized with the importance of the principles underlying this great movement. I therefore desire this evening to bring to your attention certain salient facts concerning our natural resources, their proper development and their conservation.

It is a common idea that the conservation of our natural resources means hoarding them for the use of future generations. This is an entire misconception. Most of our natural resources are best conserved by working and developing them. Our forests, our lands and our fisheries will, if properly worked, not only yield this generation a larger profit, but they will be handed on to our successors in a more highly productive condition than that in which we received them. We are prosperous now, but we must not forget that it is just as important that our descendants should be prosperous in their turn. Each generation is entitled to the interest on the natural capital, but the principal should be handed on unimpaired.

The area of the Dominion of Canada is about 3,730,000 square miles, which is somewhat greater than that of the United States, including Alaska, and rather less than that of Europe.

In Canada, as in every other country of the world, the physical features have played, are playing and will continue to play a most important part in the development of the history of the country and the character of its people.

Looking back into the abyss of past time, we find that that part of North America which we now call Canada originally consisted of three widely separated land areas arising from the waters of the primeval

*Extracts from Presidential Address, Royal Society of Canada, Montreal, May 26.

ocean. These areas are sometimes termed the protaxes or primitive axes of North America. I refer to them at the present time because, while the eastern and western protaxes, marking the lines along which our mountain ranges were subsequently developed, became more or less buried beneath the blanket of sediments which filled in this early outline of the continent, the great northern protaxis, composed of the hard granite and crystalline schists of that ancient time, has remained exposed to the present day. Its enormous expanse of 2,000,000 square miles represents more than half of the whole area of the Dominion of Canada. Driven down like a wedge into Southern Canada, it separates the older settlements of Eastern Canada from the new provinces in our west. Owing to its peculiar character it has in this way exerted a most potent and in some respects sinister influence in the development of our Dominion. It will be noted that this northern protaxis or Canadian shield, as it has been called by the great Austrian geologist Suess, barely passes south of the Canadian boundary line. The problems which it presents in Canada are, therefore, non-existent in the United States.

Physiographic Divisions.

Canada falls naturally into the following physiographic divisions:

The Canadian Shield, to which reference has just been made. This is a great plateau with an average elevation of 1,500 to 2,000 feet above sea level. A somwhat undulating, rocky country, in the south well wooded but containing little farming land.

The Appalachian Mountain System, represented in Canada by the Notre Dame and Shickshack Mountains —which crosses the boundary line from New Hampshire and runs in a curving north-easterly course through the provinces of Quebec to the extremity of the Gaspe peninsula.

The Area of the Maritime Provinces. This lies to the east of the Appalachian Mountain system—a diversified tract of country containing considerable areas of good farming land and with important coal deposits.

The Great Plain of Central Canada. This lies along the southern margin of the Canadian Shield and stretches from the Appalachian Mountains on the east to the Rocky Mountains on the west. Its eastern portion lies in the provinces of Quebec and Ontario, its western and larger portion in Manitoba, Saskatchewan and eastern Alberta. It contains the greater part of the farming land in the Dominion.

The Cordilleran Mountain System, of which the Rocky Mountains are the eastern range. This system of mountain ranges with its intervening valleys and plateau land bounds Canada on the west and embraces British Columbia and western Alberta. It has the finest surviving forests of the Dominion and is rich in minerals. It contains, however, only a relatively small amount of farming land which can be cultivated without irrigation.

Natural Resources.

The natural resources of the Dominion, on which the population of Canada must depend for their support are six in number:

1. Agriculture and the cattle trade.
2. Forest products, timber, pulpwood, etc.
3. Water powers.
4. Products of the mines.
5. Fisheries.
6. Fur trade.

Speaking generally, our manufacturers and transportation systems are dependent upon these and, therefore, stand or fall with them.

The relative importance of these several sources of national wealth, as expressed in the monetary value of their respective products, is shown in the accompanying table. The figures are obtained from the Government returns for 1913. In the table there is also given, for purposes of comparison, the value of the exports of each of these national products:

	Output.	Exports.
Agriculture (field crops).	$552,771,500	$194,930,254
Forests, (1912) . .	182,300,000	43,255,060
Mines.	144,031,047	57,442,546
Fisheries.	33,389,461	16,336,721
Furs.	. . . . .	5,415,118

Agriculture.

Agriculture is and must always remain the chief industry of the people of Canada. The population which the Dominion can support in the future will depend chiefly upon the area of land suitable for farming which exists in Canada and the manner in which this is cultivated. The fact that Canada occupies more than half of the continent of North America and has an area almost identical with that of Europe is sometimes mentioned as carrying with it the implication that it would afford support to an almost unlimited population. It is impossible at the present time to arrive at an accurate estimate of the actual area of arable land in the Dominion, but there are certain salient facts which, while not generally recognized, have a very important bearing on this question. The first of these is that there is practically no land which can be properly cultivated in that portion of Canada which lies north of the area covered by a forest growth. Secondly, with the possible exception of the clay belt in northern Ontario, there is no part of the Canadian Shield which can support more than a very sparse farming population or in which farming can be made a really profitable industry. The recent report of the Commission of Conservation on the condition of the farming community on the southern margin of the shield on the watershed on the Trent Valley Canal in southern Ontario, shows a state of affairs long recognized by those familiar with the Laurentian country. Thirdly, the area of arable land in British Columbia, as compared with the size of the province, is quite small.

There are only two great areas of land capable of continuous cultivation throughout their entire extent and of thus supporting a large agricultural population. The first of these is the plain lying between the southern margin of the Canadian Shield and the boundary line of the United States in Quebec and Ontario, extending from the hilly or mountainous district of the Appalachian folding in eastern Quebec to the Great Lakes. The second is the southern portion of the plains in the provinces of Manitoba, Saskatchewan and eastern Alberta. These, in referring to the physiographic divisions of Canada, were classed together as the Great Plain of Central Canada.

Forest Products.

The forests of Canada were its chief source of revenue in the early days of the settlement of the country. Year by year the great rafts of timber were floated down the St. Lawrence and Ottawa rivers past Montreal, and were loaded on fleets of ships at the

port of Quebec. Later, with the advent of railways, the same lumber was brought in immense quantities by rail to Montreal or shipped directly to its market in the United States. The following table shows the total forest products of Canada for census years, going back to the year 1871, expressed in cubic feet:

1871	1,386,122,654
1881	1,999,544,178
1891	6,955,024,616
1901	4,762,235,878
1910	2,084,000,000

Notwithstanding this continuous drain upon our forests and the tremendous losses which they have sustained by fire, the general opinion of the people of Canada, an opinion to which from time to time expression is given in the utterances of our public men, is that the great northern forests of Canada are so extensive that they are practically exhaustless and will afford an abundant supply of timber for all future time, a supply which will not only meet our own needs, but will be amply sufficient to make good the increasing demand of the United States, due to the disappearance of its own forests, and also afford a surplus for export to Great Britain, South America, the West Indies and other countries as at the present time. A closer examination of the facts of the case obtained by investigations carried on during recent years, however, reveals a number of interesting and very important results.

A careful study of the question by the official forester of the Dominion shows that so far from being exhaustless, the reserves of merchantable soft timber in the forests of Canada are only between one-quarter and one-fifth of that remaining in the forests of the United States. Of these reserves in Canada, about one-half is in the old provinces of Eastern Canada and the other half in British Columbia. The evidence goes to show that at the present rate of cutting the supply of timber will within a comparatively few years be sufficient only for the needs of the Dominion itself, leaving no surplus for export.

Mines.

Mining is the only industry in a country which from the very nature of the case cannot be permanent. Other industries—like money well invested—can be made to yield an annual return in interest while the capital remains unimpaired or even increases in value. The mineral wealth of a country may be compared to a sum of money hidden in the ground. It does not renew itself and every dollar abstracted leaves just so much less for future use. "Yet it is a singular fact," as remarked by a recent writer referring to the United States, "that among a people supposedly grounded in the rudiments of political economy, the progressive exhaustion of this precious resource is everywhere heralded as a triumph of enterprise and a gauge of national prosperity. The nation publishes periodically the record of its scattering of assets never to be regained and waits with a smile of complacence for general congratulation."

Great mining regions in the older countries of the world worked for many years have now become exhausted. Among these may be instanced the Kongsberg mines in Norway, which at one time produced great masses of native silver rivalling those now obtained from Cobalt; the lead mines of Great Britain, now completely abandoned; the celebrated mines of the region about Freiberg, in Saxony, the last of which is now about to be closed down; and the great diamond fields of India, which no longer yield these precious gems.

In Canada our mineral deposits are of great extent and importance. The value of the mineral output is increasing rapidly year by year. Our coal resources, as shown by the investigations undertaken in connection with the International Geological Congress, which was held in Canada last year, are in extent second only to those of the United States. The geological structure of the Dominion, moreover, is such as to lead to the confident belief that as detailed exploration is carried forward in Northern Canada, large deposits of the metallic minerals will be found in that portion of the Dominion—so that the mining industry of the Dominion, there is reason to believe, will play a very important part in the future history of the country. It is, however, of the greatest importance that we should avoid all waste in the development of these resources. The losses sustained in other countries from lack of care and thought in this respect are enormous. Dr. Douglas estimates, for instance, to take only one example, that at the Rio Tinto mines in Spain in a period of some thirty years, through the unskilful treatment of the ore, about 7,000,000 tons of sulphur, valued at not less than $70,000,000, were wasted, while with modern improvements in the method of handling the ore, about 1,000,000 tons of sulphur are annually saved to the world which would otherwise have been burned and served simply to pollute the atmosphere. The same writer points out that only some 60 per cent. of the hundreds of millions of dollars yielded by the Comstock lode was recovered at the time and at first the enormously rich tailings were not even collected, such was the haste of the miners to empty that stupendous deposit which should have made Nevada prosperous for generations instead of whirling the whole country into a mad dance of reckless speculation. The primary cause of a large part of this waste is over-capitalization, which involves a large output at any expense if the value of the shares is to be raised and their price maintained. Over-capitalization generally demands over-production, which in its turn almost invariably involves waste at some stage of the progress of the metal from the mine to the consumer.

Perhaps the most serious waste which is taking place in the Dominion at the present time in connection with its mineral resources is presented by the mining and utilization of coal. In the first place, in mining a coal seam from 50 to 90 per cent. of the coal is left in the workings for the purpose of supporting the roof. Of the coal which is taken out and burned under boilers in the usual manner, only about 12 per cent. of the total energy is developed. That is to say, we secure for useful purposes only about 5 per cent. of the total energy contained in the coal contained in the area. If the coal is burned in gas producers and the gas so obtained used in internal combustion engines, these, having a higher efficiency, develop about 30 per cent. of the energy in the coal actually mined, or about 12 per cent. of the energy locked up in the coal of the whole area. This is an improvement, but still represents an enormous waste.

On the other hand, the coal may be mined for the production of coke for metallurgical purposes. About three-fourths of the coke produced for this purpose in North America and all the coke made in Western Canada is manufactured in Bee Hive furnaces, which yield a relatively low percentage of coke, while the other

products of the coal—gas, tar, ammonia, benzol, etc.—go to waste. All these products may be saved by making the coke in by-product ovens, representing in localities where the surplus gas can be sold at a reasonable rate a gain which is estimated by Mr. F. E. Lucas, manager of the coke ovens of the Dominion Coal Company, at $1.98 per ton of coke made. This figure will, of course, vary with the locality in which the coke is produced, but it emphasizes the great saving which may be effected by the use of the modern by-product oven. The tar and ammonia obtained by this process, moreover, meet with a ready market. The former is already being used extensively in the Dominion for a variety of purposes, among them as a binding material in the manufacture of briquettes from slack coal, thus enabling this waste product to be successfully utilized, while the ammonia is a fertilizer of the greatest value, for which there is a great demand abroad and for which an ever-increasing demand will arise in Canada as the necessity of employing improved methods of agriculture is brought home to our farmers.

Fisheries.

Not only is Canada richly endowed with natural resources which have their locus upon the land but she is bounded on three sides by the salt waters of the sea and running through her domain are many streams and great rivers which have their origin in thousands of inland lakes, some of these being among the largest bodies of fresh water in the world. These waters abound—or should abound—in fish and other living creatures which constitute another of our great natural resources. Canada ranks well among the nations of the world in the yield of its fisheries, in which it is estimated that 90,000 men are engaged, whose labor yields from 26 to 30 million dollars annually. The fishing industry at the present time is carried on in three distinct and separate portions of the Dominion—The Atlantic Coast, the Coast of British Columbia, the inland waters. There are also the oyster and lobster fisheries of the Atlantic coast and the fishing or rather hunting for whales and porpoises on the Arctic shores of Canada and in the waters of Hudson's Bay and the Gulf of St. Lawrence.

The fishing industry in the Maritime Provinces could be very considerably developed and be made to yield larger returns if improved methods of curing, packing and shipping were employed under proper government inspection, in this way improving the quality of the salt fish sent to market. The Dominion Government has recently made an appropriation of $10,000 for the establishment of a fisheries intelligence bureau with the object of bringing before the fishermen in some concrete way information with reference to the best methods of curing and packing their fish. The Government has also made provision for the encouragement of the trade in fresh fish between the Atlantic and Pacific seaboard and the interior parts of the Dominion by paying a portion of the regular express charges on all shipments of fresh fish from the Atlantic coast to all points in Ontario and Quebec and from the Pacific coast to all points as far east as Manitoba. While owing to certain local causes certain kinds of fish, such as shad, are less abundant than formerly, there seems to be no indication of depletion of our Atlantic fisheries as a whole. The fact that the catch has not increased more rapidly in recent years is owing largely to a restricted market.

The fishing industry in British Columbia presents a marked contrast in many respects to that of our Atlantic coast. Salmon is by far the most important fish taken and it is for the most part canned for shipment. The fish are taken when coming in from the sea to spawn in the rivers and are thus easily secured. The value of the salmon catch in British Columbia has increased enormously in recent years, amounting on an average in the years 1908 to 1911 to considerably over $7,000,000. Year by year the canneries are increasing the number and size of their plants and the number of their boats, while across the mouth of the Fraser River the nets form a veritable barricade. With such intensive fishing it can hardly be expected that the industry will not suffer. Although the run varies greatly in different years, the fish being especially abundant every fourth year, a careful study of the subject by Professor McMurrich goes to show that the supply of fish is gradually diminishing and this opinion is shared by most of the canners, although the extension of their plants is contributing all the more rapidly to the extinction of the supply. The question as to what can be done to conserve this most lucrative industry on our Pacific coast is one which presents peculiar difficulties. The salmon coming in from sea to spawn in the Fraser River pass by the coast of the United States on the south side of the Gulf of Georgia and are there taken in enormous numbers by United States fishermen. Up to 1908 the Canadian canners on the Fraser River were catching more than the Americans, but now the state of affairs is reversed and the Americans are catching twice as many as the Canadians. The conservation of these fisheries, therefore, is an international question and one which should be made a subject of immediate consideration by the governments of the countries concerned, if the industry so valuable to both countries is to escape destruction.

The Fur Trade.

The rise of the fur trade was almost coincident with the discovery of Canada, and with the establishment of the great fur trading companies, their agents penetrated ever farther into the interior of the country until fur trading stations had been established in every accessible part of the area now embraced within the borders of the Dominion of Canada.

In recent years the ever advancing network of railway and steamboat communication have made it possible for hunters to carry their provisions and supplies into remote recesses of the continent which have hitherto been practically inaccessible. The last retreats of the furbearing animals have been invaded by their remorseless enemy, man. The musk ox, for instance, has only figured in the London sales during the last forty years—before that time the hunters of the Arctic regions were unable to reach its habitat; the continued invasion of its territory makes its extinction more than probable in the not distant future. As a result of these inroads, the fur-bearing animals are everywhere decreasing in number and notwithstanding the fact that hunting is everywhere being carried on with increasing vigour by the aid of modern guns, smokeless powder, improved traps and the most alluring baits and scents, the supply of furs obtained is constantly diminishing. Coincident with the falling off in the supply, there has been a remarkable increase in the demand for furs, especially for the most costly varieties. This has been most marked during the past twenty years owing to the increase of population and

wealth among the people of northern countries where furs are required not only for comfort but also to satisfy the requirements of fashion. The value of the furs exported from Canada in the year 1913 was $5,415,118. This increased demand has, of course, been accompanied by a steady rise in price.

While the most costly furs are in ever-increasing demand notwithstanding their ever-increasing price,—for the mere fact that they are enormously expensive creates an inextinguishable desire for them on the part of certain people—there has arisen an increasing demand for cheaper furs also. Scarcely any animal that has a furry coat, is now safe to walk around, for some one seizes and slays it, although the pelt continues its existence under a name and often under a guise in which its original possessor would never recognize it. Thus, goats become transformed into bears, hares or minks into sables, muskrats and rabbits into sables, or seals or electric seals; opossum into beaver, white rabbits into ermine, white hares into chinchilla, racoons into silver bear. Even the domestic cat, hitherto an unappreciated national asset, having changed its plebian designation for one which finds more acceptance in good society, "arrives," and in so doing often helps its wearer to do so also.

Furs can, of course, only be produced under certain climatic conditions, and these are nowhere more favorable than in our Dominion. The breeding of fur-bearing animals is an industry of great promise, which should, if carried on in a conservative and rational manner—as any other industry must be to meet with success—have a great future in Canada and be an additional source of wealth to the Dominion. It is not, I think, generally recognized that a number of the more important of these animals are already being bred in captivity—several of them in Canada—with success, although as yet only on a small scale. Among these are foxes of several varieties, mink, martin, fisher, muskrat, racoon and skunk. The skins of the animals bred in captivity bring a higher price in the market than the skins of the same animals taken in the forest. Fox farming, especially in Prince Edward Island, indeed, although more or less discredited by the excessive speculation with which it has been associated, has proved to be a successful industry and one which is capable of great expansion. There are now on Prince Edward Island 233 fox "ranches," containing 2,480 foxes, of which 1,325 are silver-black foxes. The sworn value of these was slightly over $3,700,000, from which the Provincial Government derived an income of $37,000. The black and dark silver skins from foxes produced on the Prince Edward Island ranches have rarely brought less than $500 apiece and frequently over $2,000 at the London auction sales.

Much also could be done to prevent the extermination of our fur-bearing animals by making all our national parks and forest reserves "sanctuaries" for the animals who are their natural denizens. A sanctuary has been defined by Colonel Wood as a place where man is passive and the rest of nature active. This can be done by maintaining a really efficient system of patrol, with the prompt arrest and punishment of all who break the forest laws. Some of our parks are so protected and it is found that the animals rapidly increase in them and spread out into the surrounding forest. Many of our forest reserves, however, are absolutely without protection or patrol.

Conclusions.

In conclusion it may be said that we have seen that Canada has been blessed with great natural resources. Each and all of these, however, already show signs of serious depletion.

Our mineral resources, like the mineral resources of every country, are in the very nature of the case being depleted in direct proportion to the growth of our annual output of the products of mine and quarry.

Our forests, which are by no means so extensive as is generally supposed, have been cut, slashed and burned in a reckless manner.

Our agricultural lands, although showing an ever-increasing output on account of the opening up of new tracts of virgin soil, are not yielding even approximately the returns of which they are capable were they farmed according to more improved modern methods.

The maintenance of our water powers at their maximum efficiency is threatened if the forest areas of their catchment-basins are not preserved.

The fisheries of British Columbia and of our inland waters are in serious danger.

With the continued advance of settlement our wild fur-bearing animals are in course of extermination.

Each and all of these resources of our national domain, (with the exception of the mineral deposits), can, however, not only be restored to its original condition but may, if we take vigorous action at the present time, be conserved, cultivated and not only be made to yield a higher annual return than at present but while doing so to increase in value year by year, and be handed on by each generation to the succeeding one in a better and more productive condition than it received them.

It is time for the people of Canada to awake to the realization of these facts, and in so doing to remember that in the last analysis the success of any policy of conservation depends upon the efficiency of the human unit. The instinct of the savage which still survives in the ordinary man inclines him to seize what he can now and for himself and let others, including posterity, take their chance. The national instinct for the preservation of the state does not, however, lend itself to any such practice of personal aggrandizement and selfish waste. Canada should learn the lesson exemplified in the rise of such a powerful state as Germany —relatively poor in natural resources, but becoming rich by their careful conservation and able husbanding.

This conservation is part of that "righteousness which exalteth a nation." And finally, let us remember that—in the words of Dr. James Douglas—we should be preservers of the gifts with which a beneficent Providence has stored our world, for next to being a creator man reaches his highest position in being a saver—a saviour.

On the occasion of the 50th anniversary of the School of Mines, Columbia University, May 29th, 1914, Carl A. Meissner, among others, had conferred on him the honorary degree of Master of Science in recognition of his services in the manufacture of iron and steel. Mr. Meissner is Chairman of the Coke and Blast Furnace Committees of the United States Steel Coporation and was formerly connected with the Dominion Iron and Steel Co., Sydney N. S.

MR. D. A. THOMAS' PROJECTS.

London, June 10.

With regard to D. A. Thomas, the Welsh coal magnate who has just returned to this side from New York, the Financial Times says: "With reference to the important projects which D. A. Thomas, chairman of the Consolidated Carribian Company, has recently had under negotiation for the development of the coal mining industry on the other side of the Atlantic, it appears that arrangements have already been entered into involving a capital sum of nearly £3,400,000, which amount may quite possibly be added to hereafter.

"The net result of Mr. Thomas' operations will be to explore some thousands of miles of land in Canada, while certain areas in the United States are also being taken in hand and great expert coal miners from Great Britain will be induced to try their fortunes in the United States and the Dominion.

"It is probably upon this aspect of the situation that the Canadian authorities put the greatest store. Owing to his prominent position in the English coal trade, Mr. Thomas is not likely to find any difficulty in financing his schemes, on the contrary, it is thought he has already made necessary arrangements in this country, by means of private negotiations.

"This may possibly be followed by an appeal for public support, but the policy to be pursued in this connection has not been made known. It is satisfactory to find that Mr. Thomas' incursion into the United States and Canadian coal fields has been well received, and is regarded in both countries as a development with which they may be well satisfied. As enterprising as are the coal operators in the United States they practically admit that they have something to learn from the English experts and particularly from one who has shown himself to be one of the most astute organizers in the world."

CALUMET AND HECLA.

Boston—The report of Calumet and Hecla Mining Co. for the year ended Dec. 31, 1913, shows production of 45,016,890 pounds of copper, produced at cost of 14.25 cents per pound. Previous year's production was 67,856,429 pounds, and cost 9.86 cents.

The report contains a statement by President Shaw, to the effect that the re-treatment of the company's tailings by regrinding and leaching, is expected to show a total net profit of about $20,000,000.

All the buildings for the new recrushing mill have been finished and about one-half the machinery erected. The work of installation should be finished this summer. It has been estimated that the above mill, working at its capacity of about 3,000 tons a day, would retreat the available sands in Torch Lake in about 30 years and save five pounds of copper per ton at a cost of about six cents, giving a profit if sold at 13½ cents per pound, of something over $10,000,000, less the cost of the mill and power equipment. Experiments that have been carried on during the past two years show that a leaching process has been developed which can be applied to a large proportion of the waste tailings of this recrushing mill.

The results so far obtained by the use of this process indicate a further saving of copper at a cost which will give an additional profit from the sands of about $10,000,000, or a total net profit of about $20,000,000. This process can also be used in further re-treatment of a large portion of the tailings that will result from milling the balance of the Calumet conglomerate rock as yet unmined. It also will be effective in making large savings and increased profits in the re-treatment of the Tamarack sands and the milling of White Pine rock, in which companies the company is a stockholder.

TECHNICAL EDUCATION IN NOVA SCOTIA.

The Mining Society of Nova Scotia at a recent meeting made the following resolution:

Whereas, One of the most pressing needs of the present time in the mining and other industries in Canada, is an increase of facilities for our workmen for technical education, and whereas, The provision for general industrial training in foreign countries has been one of the largest factors in the phenomenal increase in industry and commerce, and in the general happiness and well being of the people; and, whereas, The Royal Commission of Technical Education and Industrial Training has recently made certain recommendations to the Dominion Parliament for the increase of facilities for technical education throughout Canada.

Resolved, That the Mining Society of Nova Scotia, assembled in its annual meeting at Sydney, Nova Scotia, do urge the Dominion Government to take favorable action on the recommendations of this Royal Commission; and further resolves, That this society also urges the Government of the Province of Nova Scotia to cooperate with the Government of Canada in such manner as will bring about definite results in regard to the recommendations of the Commission; and further resolved, That copies of this resolution be sent to the Premier of Canada, including all members of the Cabinet, Premier of Nova Scotia, and representatives of the Province, in both Federal and local Parliaments.

An oil-fired blast furnace has been put in at the Copper King mine, Chewelah, Washington, by Mr. J. J. Anderson, patentee. It is stated that this is the first furnace of the kind installed in the Northwest for smelting copper ore on a commercial scale. For some time several years ago, experiments were made at Van Anda, Texada Island, British Columbia, under the direction of Mr. Thos. Kiddie, metallurgist, formerly superintendent of the Northport Smelting and Refining Co's smelting works at Northport, Washington, and on his recommendation Mr. Anderson made improvements suggested by the experience gained in the demonstration at Van Anda of the suitability of the Anderson oil-fired furnace for reducing copper ores, but the several runs were short ones—of only a few days each. The installation at Chewelah is, however, intended to be for continuous operation, so results will be looked for with much interest. The treatment capacity of this furnace is stated to be about 100 tons a day. As the United Copper Co. has more than 7,000 tons of ore, averaging 5 per cent. copper, ready for smelting, there is no question of insufficiency of ore supply, so the oil-fired furnace will be given a fair trial.

Thus far petroleum has been utilized mainly for illuminating and lubricating and of recent years as motor fuel. It is principally in demand for motor fuel which has resulted in the rapidly increased production. For some years oil has been used as fuel for locomotives in several countries, but principally on roads where heavy oil is found, such as in California, where Atchison and Southern Pacific adopted liquid fuel. The great navies are adopting petroleum without waiting for the perfection of the internal combustion engine. Principal reasons are greater radius of action, increased speed, reduction in labor and absence of smoke, making location of a ship more difficult for the enemy.

PERSONAL AND GENERAL

Col. A. M. Hay has returned to Toronto after examining mining property in Nova Scotia.

The Duluth office of the H. W. Johns-Manville Co., has moved to larger quarters at No. 327 W. First Street, in order to take care of its increased business.

Mr. W. A. Thomas, who for several years past has been Commercial Engineer in charge of all sales of mining apparatus for the Westinghouse Electric & Mfg. Company with headquarters at East Pittsburg, resigned his position with this company on June 1st, and has taken up the practice of Consulting Engineering in Pittsburg with office in the Second National Bank Building .

Mr. J. C. Houston, manager of the Schumacher mine, has returned to the mine after being in Toronto for a few days.

Mr. A. A. Hassan has completed an examination of the Crimora Manganese Mine Augusta Co., Virginia, and is now examining gold mines in Esmeralda Co. Nevada.

Mr. J. W. Astley has been spending a few weeks in Victoria, B. C.

Prof. J. W. Bell was in western Canada last month with the McGill senior students in mining engineering. The summer school itinerary ended at Rossland, whence the students dispersed and went their several ways.

Mr. Lorne A. Campbell, of Rossland B. C., general manager for the West Kootenay Power and Light Co., endeavored to make an automobile trip to Fort George, but did not reach his intended destination with his motor car. There are good roads for many miles through Cariboo district, but not as far north as Fort George in the early spring.

Mr. C. G. F. Carlston has left the employ of the British Columbia Copper Co., operating in Boundary and Similkameen districts of British Columbia and has gone to Tonopah, Nevada.

Mr. James Cronin, of Spokane, Washington, for years manager of the St. Eugene lead-silver mine in East Kootenay, B. C., was at Halcyon hot springs on Arrowhead lake. B. C., late in May.

Mr. R. E. Hore has returned to Toronto after visiting mining districts in the Maritime Provinces.

Mr. J. Victor Culbert, formerly at the Hollinger mine, Porcupine, was at Nelson recently, after having been travelling in Mexico and Alaska.

Mr. R. W. Brock, deputy minister of mines, made a somewhat hurried trip to Alberta and British Columbia last month. At Calgary he made enquiries concerning the reported discovery of oil in commercial quantity, and afterward went to Nelson, B. C., to look into the zinc-smelting question there.

Mr. S. Duncan Ellis, who recently graduated in mining engineering from Toronto University, has gone to the Braden copper mines, near Santiago, Chile.

Mr. Harry A. Guess, of New York City, who some years ago was associated with his brother, Prof. Geo. A. Guess, of Toronto University, in assaying in British Columbia, was in the Coeur d'Alene district, Idaho, about the middle of May.

Mr. J. M. Harris, long known in connection with the Reco and other mines in Slocan district, B. C., has returned to Sandon, Slocan, from a three months' trip to Mexico and other countries.

Mr. Howard W. Kitson is now general superintendent for the British Columbia Copper Co., at the group of mineral claims on Copper mountain, Similkameen, B. C., the company has for two or three years been developing under option of purchase.

Prof. Arthur Lakes has returned from a lengthy visit to England, and is now with his son, Mr. Arthur Lakes, Jun., who is manager of the Ymir-Wilcox gold mine, near Ymir, B. C.

Mr. Harold Lakes is superintendent of the Silver Hoard mine, near Ainsworth, B. C.

Col. N. E. Linsley, of Spokane, Washington, during the latter part of May examined the new development workings at the Payne mine, Slocan, B. C., whence he was accompanied by one of the owners.

Mr. T. L. McAllister, for years superintendent of the Noble Five group of mines near Cody, Slocan, B. C., has retired from that position and gone ranching in the Coast district. Mr. Paul Lincoln, late of Chihuahua, Mexico, is now in charge at the Noble Five.

Mr. Geo. C. Mackenzie, chief of the metallurgical division of the Mines Branch, Canada Department of Mines, has returned to Ottawa from Nelson, B. C., the experiments in electric smelting of lead-zinc ores of which he had supervision at the latter place having been discontinued.

Prof. J. Bonsall Porter, of Montreal, has returned from a trip to western Canada with his McGill summer mining school of senior students in mining engineering. After a visit to Cobalt and other parts of Ontario, the party went to coal mines in Alberta and Southeastern British Columbia, and afterward spent a week in Boundary and Rossland districts at mines and smelting works there.

Mr. R. J. Spry, who last year was superintendent at the Eureka mine, near Nelson, B. C., has returned to British Columbia from a trip to eastern Canada, and is now at Victoria.

Mr. Stuart J. Schofield, of Ottawa, has commenced his season's geological survey work in East Kootenay district, B. C. He is scheduled to complete the mapping of the area situated between that included in the Cranbrook map and Kootenay lake, and to afterward study the silver-lead ore bodies in Ainsworth camp and the recently discovered deposit of tin ore in Lardeau district.

Mr. Wm. Thomlinson, for years actively engaged in prospecting and mining in Slocan district of British Columbia, has been engaged by the Dominion Government to collect representative specimens of the ores, and other minerals of the province for the Canada exhibit at the Panama-Exposition next year.

Mr. E. E. Ward, formerly superintendent of the Silver Hoard mine, near Ainsworth, B.C. ,is now with the Granby Consolidated Co., at its Hidden Creek mines, near Anyox, Observatory inlet.

Mr. Roy Wethered, who for some time was with the Consolidated Mining and Smelting Co., at mines in Ainsworth camp, has opened an office, as consulting mining engineer, in Spokane, Washington.

Mr. Clyde B. White, formerly superintendent at the Idaho Alamo mines in Slocan district, B. C., has taken a similar position in the Portland Canal district of the same province.

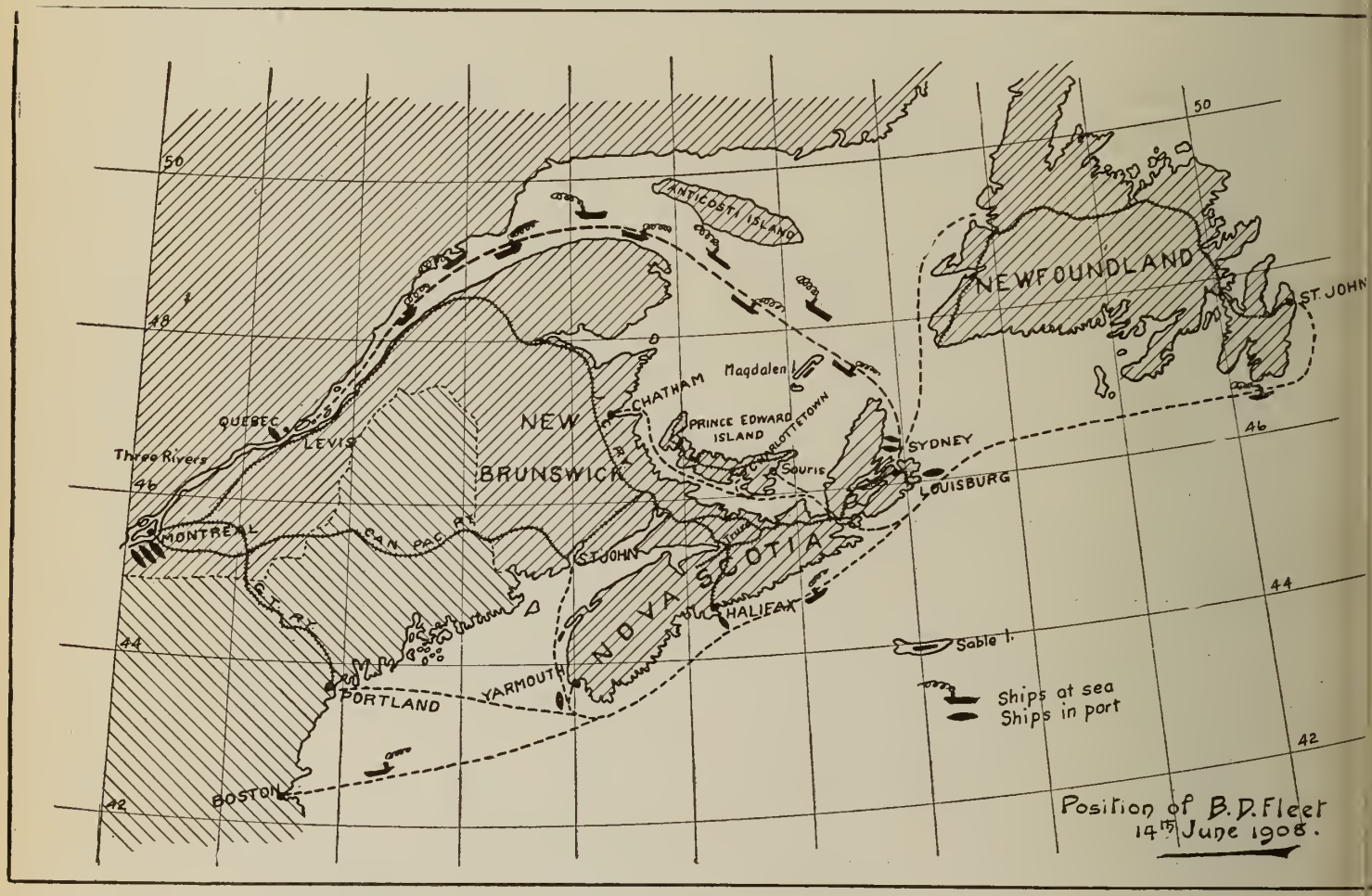
Mr. James Wilding, Jun., formerly of Parral, Mexico, has been at the mill on Four-mile creek, Slocan, of the Silverton Mines, Ltd., operating the flotation plant put in there by the Minerals Separation American Syndicate, Ltd. It is stated that the flotation process is making a satisfactory recovery at the mill just mentioned.

SPECIAL CORRESPONDENCE

NOVA SCOTIA

Coal Freighting in the St. Lawrence River.

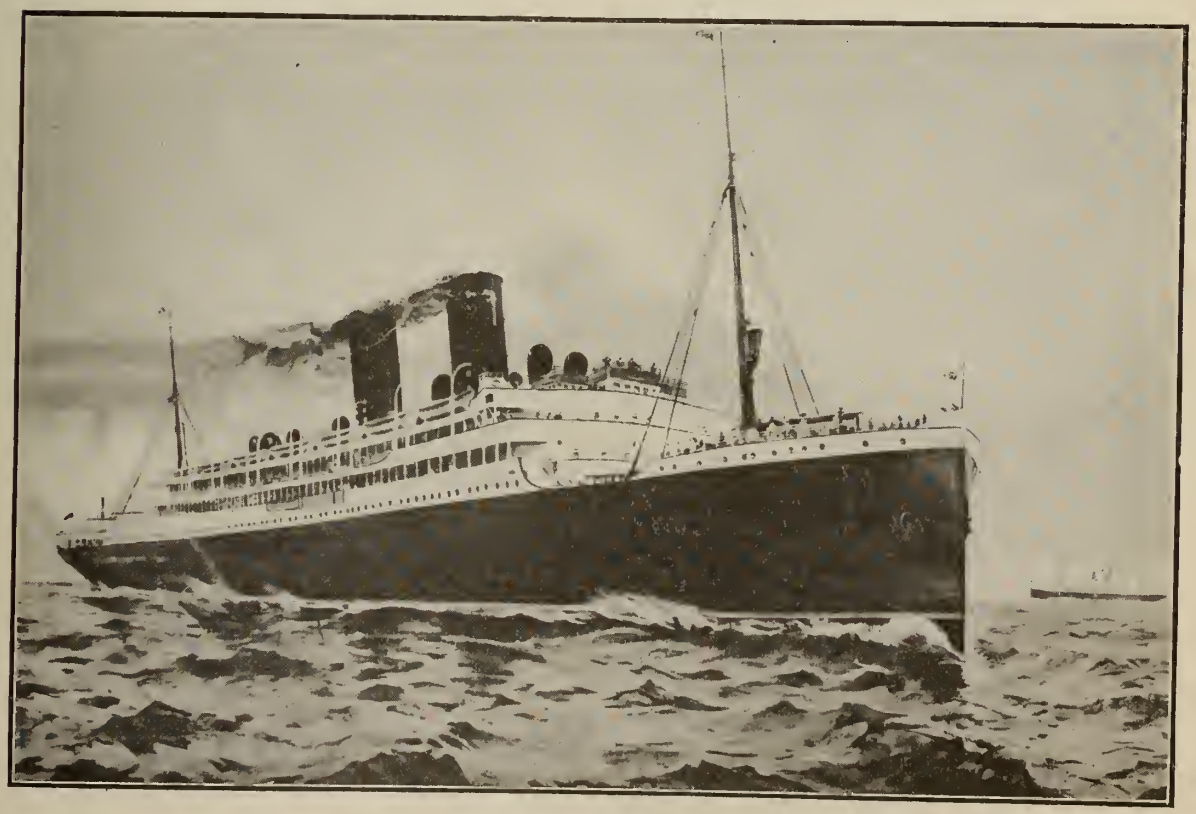
The recent disaster to the "Empress of Ireland" has brought into prominence a feature of the St. Lawrence shipping route that is very familiar to those who have occasion to sail these waters, but on which the general public is but little informed. Between the beginning of May and the end of October the Dominion Coal Company expect to dispatch no less than two million tons of coal from Cape Breton to Quebec and Montreal, and the Nova Scotia Steel Company will ship about 350,000 tons in the same period. In the week ending the 30th May the Dominion Coal Company sent out from Sydney almost 100,000 tons—to be exact 99,000 tons of coal destined for the St. Lawrence ports, contained in 14 steamers of between 7,000 and 10,000 tons capacity each. This is the best shipping record the company has yet achieved, but it is only typical, on a slightly larger scale, of what has taken place every week throughout every Summer during the past ten years. It is within the mark to state that 80 per cent. of the shipping tonnage plying the St. Lawrence route is engaged in the transportation of coal. From the time that the drift-ice will permit of navigation until the buoys are taken up in the Autumn the procession of coal-boats coming and going from Sydney could occur to a well-found steamer like the "Empress" within sight of land, and that a thousand people should find death in a little over one hundred feet of water. The small percentage of accidents that have occurred in connection with the coal-freighting trade in the St. Lawrence is evidence of the careful and competent navigators that are employed in this trade, a fact that the "Empress" accident but serves to throw into greater prominence, when the circumstances are properly considered.



Members of the mining profession in Canada will be filled with regret at the death of Dr. and Mrs. A. E. Barlow, particularly those who heard Dr. Barlow give his valedictory address at the close of his Presidency of the Canadian Mining Institute in March last. Nova Scotia members of the Institute and the members of the Nova Scotia Mining Society remember Dr. Bar-

As to the question of blame in the recent appalling event, it would be premature to anticipate the deliberate pronouncement of the investigating authorities, except that from the meagre details which have transpired it appears to be the outcome of an unfortunate concatenation of circumstances, and there is dreadful irony in the fact that such a catastrophe

The Collier "Storstad" entering Montreal Harbor.



The C. P. R. Liner, "Empress of Ireland"

low's presence in Haliafx when he accompanied a deputation from the larger Institute looking towards the affiliation which it is hoped may be brought about before very long, and it is with great sorrow that the Nova Scotia members of both Institutes hear of Dr. Barlow's name among the many who are missing.

Dominion Coal Outputs.

Dominion coal outputs for May will show about 406,000 tons from the Glace Bay mines and 34,000 tons from the Springhill Mines, comparing with 403,000 and 31,000 tons respectively in May 1913. The aggregate for the first five months of the year compares with 1913 as follows:

	First 5 mths. 1913 tons	First 5 mths. 1914 tons
Glace Bay Mines	1,899,683	1,803,000
Springhill Mines	163,836	166,000

During May the drift-ice interfered most seriously with shipping around the coasts of Cape Breton. On the fifteenth of the month the ice-blockade was so thorough that it was necessary to lay idle the whole of the collieries, an unprecedented occurrence from this cause, and on several other occasions the mines had less complete enforced idleness. But for the hindrance imposed by the drift-ice the production would have reached 440,000 tons.

The Springhill Mines silghtly exceeded the 1913 production and have now completely recovered from the reduction in output caused by the fire.

During the Summer months it is expected that the Glace Bay mines will produce considerably in excess of last year, and will overtake the decrease of 96,000 tons shown by the aggregate at the end of May. Daily outputs of over 19,500 tons are now being obtained, and during the Summer the long coveted production of 20,000 tons in one day from the Glace Bay collieries will probably be realized. The collieries of the company were never in better physical shape for the production of coal, and although the figures at the end of May, owing to a combination of circumstances having no relation to the capacity of the mines, show a falling off in comparison with last year, it is to be anticipated that by the end of the season of navigation, the position will be reversed. In making such a statement it must be remembered that the Summer production in 1913 was on a greater scale than any previous production.

BRITISH COLUMBIA

Two mining towns in the Province have lately been considerably damaged by fire, and a similar disaster has been experienced at a colliery at South Wellington, Vancouver Island. On May 14 there was a fire loss at Stewart, at the head of Portland Canal, estimated at about $75,000. The property destroyed included the Dominion Government telegraph office, the Portland Canal "Miner" building and plant, Mr. George A. Clothier's assay office with appliances and supplies, and other buildings and their contents. On May 23 much damage was done to the business section of Atlin, in Cassiar district, where the buildings consumed included the post office, Dominion telegraph office, seven or eight stores, three hotels, the Overseas club, Presbyterian church, and a number of residences. Both Stewart and Atlin are distributing points for their respective mining districts, so the indirect as well as the direct loss is considerable, and the inconvenience great for the time being. The Pacific Coast Coal Mines, Ltd., lost its South Wellington colliery, tipple and other property, and there incendiarism is suspected, the company having for more than a year had much trouble with strikers, members of the United Mine Workers of America, and having during its recent months operated its mines with non-union labor.

Slocan.

Slocan Star.—Ore has been found in the lowest level of the Slocan Star mine, near Sandon. This development is especially satisfactory, since it proves the downward continuation of ore shoots that at higher levels were opened some time ago. Particulars have not yet been received, but as the information has been obtained first-hand it may be regarded as authentic and quite dependable. Preparations are being made to shortly start work at the Slocan Star concentrating plant, which has been unused for years; much milling ore has been developed during the last year, so that when a commencement shall be made there will be an ample supply to keep the mill in constant operation.

Wonderful Mine.—It is reported that underground exploratory work in the Wonderful mine, situated about two miles from Sandon, has resulted in the discovery of ore in considerable quantity. Some years ago much surface wash on this claim was hydraulicked, and 400 to 500 tons of high-grade galena was recovered, but the vein from which it came was not found in an adit driven in search of it. Last year Mr. Clarence Cunningham and associates acquired the mine under option of purchase, and since then work has been done under the direction of Mr. J. P. Keane, whose efforts are now reported to have proved successful.

The Van-Roi Mining Co. has sent out from its office in London, England, the cabled report for the month of April received from the managers of its silver-lead-zinc mine and concentrating mill in Silverton camp, Slocan district. The mill report shows that the total quantity of ore crushed during the month was 2,128 tons of an average assay of silver 13.3 oz. to the ton, lead 1.9%, and zinc 4.9%. This yielded 11 tons of picked ore averaging 481.9 oz. of silver to the ton, 61.7% lead, and 8.6% zinc; 65 tons of lead concentrate assaying 216 oz. of silver to the ton; 47.6% lead, and 14.9% zinc; and 90 tons of zinc concentrate assaying 75.8 oz. of silver to the ton; 2.8% zinc. The mill was operated 456 hours. The total approximate value of the products was $13,967. The expenditure during the month was: On development, $3,926; ore-production, $4,665; milling, $3,736; and capital and other expenditure, $2,121; total, $14,448. These figures compare with three previous months thus: January, total value of products, $18,329; expenditure, $14,194. February, total value of products, $15,776; expenditure, $12,729. March, total value of products, $21,889; expenditure, $17,823. The balance to credit for the four-months' period is $10,767. There was done in April 303 ft. of development work. In one raise from No. 5 level there was 36 in. of ore which for 4 ft. averaged 48 oz. of silver to the ton, 4% lead, and 4% zinc; in another raise from the same level a stringer yielded 1.25 tons of high-grade ore and 79 tons of concentrating ore. In still another raise from No. 5, favorable ground was encountered at 147 ft. up; development was similarly favorable in a drift being run at 98 ft. below that level.

Nelson.

Work has been resumed at the Consolidated Mining and Smelting Co.'s Molly Gibson mine, situated at the head of Kokanee Creek, a tributary of Kootenay River which it enters about a dozen miles above Nelson. The snow lies very deep during several months of the winter at the high altitude of this mine, and there are snow-slides to reckon with, so it is not advantageous to work it during the first three or four months of the year. A repair gang of men is putting the aerial

tramway into working condition, so that shipment of ore over it may be resumed shortly.

For test purposes, a shipment of about 40 tons of complex lead-zinc ores has been made from Nelson to Hartford, Connecticut, so that it may be treated in a Johnson electric furnace. The ore was selected by Mr. W. McA. Johnson, when he was at Nelson a few weeks ago; including in the lot is ore from the Sullivan mine, the Standard mine near Slocan Lake, carbonate ore from the H. B. mine near Salmo, some of the old stock ore left over from the time when several years ago the Snyder electric process was being experimented with at Nelson by the Canada Zinc Co., and some zinc-iron middlings from the Bluebell concentrator on Kootenay Lake.

An action for damages before the Supreme Court of British Columbia at Nelson late in May was of much interest to miners in the district. A miner named Harrison sued the Consolidated Mining & Smelting Co. of Canada, Ltd., for $3,000 as compensation for injuries he received while working for the company at the Silver Dollar mine, near Salmo, in Nelson mining division. Prior to commencing proceedings under the Employers' Liability Act, he had, however, accepted an offer of compensation made to him by an agent of the company and had afterward received payment of sums of money under that arrangement for compensation. Chief Justice Hunter gave judgment in effect that acceptance by plaintiff of payments of money as compensation from his former employers constituted an election or choice of precedure and was a waiver of all right to further action for damages under the Employers' Liability Act. The defendant company, accordingly, was successful in resisting Harrison's attempt to recover damages after he had agreed to a settlement of his claim.

Rossland.

The Le Roi No. 2, Ltd., has sent out from its office in London, England, the cabled report for the month of April received from the managers of that company's Josie group of mines in Rossland camp. The included information relating to ore shipments and receipts and expenditure follows: Shipped to smelter at Trail 1,530 tons of ore and 168 tons of concentrate. The receipts from the smelter were $19,375 in payment for 1,413 tons of ore and $815 for 111 tons of concentrate; sundry receipts were $694; total, $20,884. Estimated working expenses for the corresponding period were $8,500 for development, $11,500 for ore production, and $1,100 for milling; total, $21,100. These figures compare with three earlier months of the current year, thus: January, total receipts $31,662, expenditure $20,400; February, total receipts $9,977 (hoisting plant shut down for a week for repairs), expenditure $17,770; March, total receipts $23,846, expenditure $18,300; totals for four months are: Receipts $86,269; expenditure $77,570; balance to credit for period $8,699. There was done in April 359½ ft. of development work on the 600, 700, and 900-ft. levels. Assay value of ore opened varied from 1 dwt. gold and 1% copper for 23 ft. in one drift on the 900-ft. level, to 4 dwt. gold and 6.5% copper for 25 ft. in a drift on the 700-ft. level. Outside of that range of value, there was in another drift on the 900-ft. level 5 in. of ore that for 6 ft. averaged 1 oz. 6 dwt. gold and 1.5% copper.

Mr. L. Shaw, managing director for the Richmond Consolidated Mines Co., has been at Rossland lately, endeavoring to arrange for more work being done on the company's group of mineral claims, situated in the south belt of Rossland camp and including the Lily May, which was the first mineral claim located in this neighborhood, its discovery dating back to several years prior to that of the Le Roi and adjacent claims on Red Mountain.

Boundary.

Developments on the 400-ft. level of the Jewel gold mine, near Long lake, eight miles from Greenwood, having proved satisfactory, it has been decided to sink the main incline shaft another 100 ft. and to drive for ore at 500 ft. depth. Where first cut on the 400-ft. level the vein was pinched and it was not until after exploratory work was done beyond a fault that was encountered that a shoot of ore was found. This ore proved to be of higher grade than any taken out at shallower levels; it averaged about $30 a ton. Approximately 1,400 tons of ore is being milled monthly and sufficient gold is recovered to pay operating expenses of mine and mill and leave a fair margin of profit beside. No gold is saved on plates, but all ore is pulped and cyanided and the product melted in the crucible, the bullion being shipped to the Dominion Assay Office, Vancouver, B.C. Mr. Chas. A. Banks, formerly of New Zealand, general manager for the Jewel-Denero Mines, Ltd., has succeeded in placing this property on a paying basis after it had for seven or eight years been non-productive.

General Notes.

The "Chahko Mika" celebration committee, in connection with a carnival to be held at Nelson on July 13-18 next, has decided to offer $1,000 for a machine-drilling contest there, and arrangements have been made for the use of a compressor to supply power, etc., for the drilling.

The mining committee of the Revelstoke Board of Trade has decided to arrange a series of business men's excursions to visit mining camps within easy reach from Revelstoke, to get in touch with the situation, the chief object being to endeavor to foster the mining industry. The first trip has been made; a number of business men went to Trout Lake City and neighborhood, and the trip was both enjoyable and a success from a business point.

The Lynch Creek Gold Mining Co., which is a reincorporation of the Handy Gold Mines Development Co., owning mineral claims in the neighborhood of Gerrard, at the south end of Trout lake, has been organized under the laws of South Dakota, U.S.A. Mr. H. A. Stratte is president, Mr. A. A. Stensund, treasurer, and Mr. H. O. Holverson, Dawson, Minnesota, secretary. It is intended to levy an assessment on the shareholders for money to do development work.

Now that the spring is well advanced, the Motherlode Sheep Creek Mining Co. has its 10-stamp Merrill mill again in operation, after three months' inactivity owing to lack of water during the severe winter weather for power purposes. Work was done in the mine all through the winter, though, so that there is now about 6,000 tons of ore available for crushing. During the fourth quarter of the company's last fiscal year there was milled 8,781 tons of ore of an average value of $13.37 a ton. The total extraction was 97.1 per cent., of which 72.1 per cent. was by amalgamation. The total cost of milling was $1.40 a ton.

The Utica mine, on Paddy's mountain, some half a dozen miles from the Twelve-mile siding on the Kaslo

& Slocan Railway, has been much hampered for the greater part of the last year in regard to transportation matters, reconstruction work in connection with changing the gauge of the railway having prevented ore being shipped last autumn, and during the winter the snow was too deep for the line to be kept open. Now, however, there is a prospect of transportation facilities being provided ere long, so the wagon road from Twelve-mile to the mine is being repaired and other preparations for mining and hauling ore are also being made.

COBALT, SOUTH LORRAIN, ELK LAKE AND GOWGANDA

Kerr Lake—As a result of the trenching on the Kerr Lake mine slope of Kerr lake, the prospects of that property have been materially brightened. On the surface the No. 10 system—which is a network of small veins admitting of profitable stoping for a width of thirty or forty feet at the 140 ft. level—has been opened up on the surface for about 300 ft. On an average it is four to five inches wide of bonanza ore. To the west the vein is good up to the Crown Reserve boundary and on the other side of the line it is being mined as No. 17 system. To the east there is good ore as far as it can be trenched until the whole slope is hydraulicked. In one spot for about forty feet it is lean calcite, but a parallel vein has been discovered, which, while not as wide, is quite as rich. It is remarkable that when the main vein loses its silver, the parallel vein becomes rich, and when the bigger ore body is again enriched the smaller loses its values. It is anticipated that between these veins there will be good milling ore as there is on the levels below. The No. 10 vein has been stoped up to, but not above the 140 ft. level. During the year ending August 31, 1913, the No. 10 vein system yielded 263,814 ounces. The discovery of the vein on the surface should at least make positive the ore stated to be blocked out in the last annual report on this vein, and there is every possibility that it will increase it since it is much richer on the surface than at any of the levels underground. It is most interesting to learn that a discovery has been made in the Keewatin formation under the diabase at the No. 3 shaft. Since this Keewatin is at the same horizon as that at the Timiskaming and the Beaver which yielded those mines their richest ore. The vein is one or two inches wide of high grade ore and was cut at the sixth level in a long crosscut.

On the second level a new vein has also been found in the diabase. It is from one to five in. wide, and is high grade ore.

At least one new vein has been found by the Kerr Lake Company as the result of dewatering the lake. It averages about 3½ in. for 75 ft., and is good at both its extremities. It will be possible to trace it further when it is hydraulicked. The vein is of bonanza ore on the surface. Crosscuts are being commenced on levels in the mine to pick up this vein and prove its depth. Trenching is also proceeding on No. 8 vein which shows a much higher grade of ore than on the levels below

There is no water now in Kerr lake, and the two pumps are making good progress in pumping the mud. Two 6 in pipes are being laid for the purpose of hydraulicking off all the detritus on the slope and also with the intent of rendering more liquid the mud in the basin. The pumps under the circumstances will make much quicker progress in freeing the lake from mud, which near the pumps is yet from twenty to thirty ft. deep.

Gould—At a special meeting the Gould Consolidated mining company decided to accept the offer of General Assets, Limited, for their two leases on Cart Lake. The General Assets company had already purchased the control of the Porcupine Syndicate stock and the Porcupine Syndicate held control of the Gould. To operate these leases General Assets, Limited, with Mr. Garnett Grant at the head, has formed a company known as the Cart Lake Cobalt with a capitalization of $2,000,000.

Up to the end of April the Gould lease, which is now controlled by the General Assets, Limited, produced 60,220 oz.

Frontier—The assets of the Haileybury Frontier mining company, owning claims in South Lorrain have been seized. A writ of execution has also been served against the York Ontario, which last year operated under lease the old King Edward mine.

Bailey—All but four or five men have been withdrawn from the underground workings of the Bailey Cobalt mine, and these few are employed in the shaft so that development has entirely ceased. The reason is stated to be that Mr. E. A. Benson, of Chicago, the president, has decided to obtain some definite recognition of his claims against the company. For the past three or four years he has provided all the money required for development without securing either a lien or mortgage. Now he is moving for one. The company owes him between $60,000 and $70,000. Reorganization will probably follow and possibly the Bailey may be merged with other and adjacent claims.

Buffalo—The Buffalo mill in the month of April treated 6,767 tons of ore, average assay per ton before milling 17.00 oz., ounces of silver recovered 85,371, ounces of silver paid for during month 51,162, Buffalo dividends now amount to $2,737,000. In the course of underground development two narrow but rich stringers have been picked up recently.

McKinley-Darragh-Savage.—For the quarter ending April 30, the production from the McKinley and Savage mines amounted to 411,954 oz. Of this about 100,000 oz. came from the Savage in high grade and mill rock. At the McKinley the mill is treating 210 tons a day on an average. No new veins have been discovered, but at the 200 ft. level several blocks of ore on the Lake and 1st Swamp vein are yielding a much bigger tonnage than was anticipated in the last annual report.

Coniagas.—After a great deal of dickering with the town the Coniagas mining company declined to accede to the measurements prescribed by the council for the trestle to be run across the street, and the shaft will be sunk at the corner of Silver street and Prospect ave. The rock will be dumped on the west side of the street and it will entail the destruction of some town property. The shaft will be sunk to the 175 ft. level to connect with the third level of the Coniagas, and crosscuts will be run to cut the two veins, which the City of Cobalt are working under the Bilsky Block and Harmony Hall respectively.

Power—By the completion and operation of the Fountain Falls plant of the Northern Ontario Light and Power company, the shortage in electrical power has been overcome. The Fountain Falls plant is now providing 3,000 horse power from its two units which should be enough to prevent any serious lack of power

in future. The lack of air remains unrelieved. Several companies who are desirous of opening up new mines or prospects cannot do so, and many of the old customers are curtailed in their operations, although they are all exceeding their original contracts. The power company, it is anticipated, will not provide more compressed air and the mines will have to instal their own compressors. In many cases the mines are running their compressors as auxiliaries now.

PORCUPINE AND KIRKLAND LAKE

Porcupine Pet.—Owing to the enterprise of Buffalo capitalists whose representative in the north is Mr. C. L. Sherrill, there is a marked activity on claims adjoining and near the Dome. The claims belonging to the Little Pet mining company have been taken over by a company known as the Porcupine Pet Mine, Limited, and the shaft has been pumped out and several drills are working at the first and the second level. The same group have taken over the Fogg and other claims and organized them as the Porcupine Porphyry Hill Gold Mines. These latter claims are quite undeveloped.

Tough-Oakes—After considerable delay the Charlton Englehart power company has been able to deliver power in the Kirkland Lake camp and the Tough-Oakes compressor is now driven by electric power. The power plant consists of two units each of 454 h.p. consisting of two water wheels separately driven. The current is generated at 2200 volts, stepped up to 33,000 volts for transmission and stepped down to 2,300 volts at Kirkland Lake. The advantage to the Tough-Oakes mine will be immediate. Heretofore the mine has only been able to work three drills, with the new plant it will be possible to operate ten.

The shaft at the Tough-Oakes mine is now down to 320 ft., the last level being at 300 ft. Here the vein does not show as yet the phenomenal high grade values of the upper levels, but it does contain a good grade milling ore, and it is anticipated that the high grade will be picked up again soon. On the 100 and 200 ft. levels the vein in the west drift is still of the remarkable high grade in the face, to the east it has faulted and to date there has not been sufficient power to endeavor to pick up the vein again. There are one or two branch veins showing remarkable ore which will be followed at once. The No. 3 vein was followed down in an inclined shaft, but faulted at 90 ft. It was picked up again at the 116 ft. level, and here shows 14 in. of over $300 ore.

Dome Lake.—At a special meeting of the Dome Lake Milling and Mining company a by-law was passed authorizing the issuance of 100,000 shares of treasury stock at 50 cents a share.

The Huronia in Gauthier township, midway between the Kirkland Lake mine and Larder Lake is now running its mine and mill with its own power, generated at a station on Beaver House lake. The plant furnishes 300 horse power to the mine at 2,200 volts, and it is stepped down to 550 for distribution to the motors.

Energetic development is proceeding at the mine.

Hunton—Mr. Harry Cecil has commenced diamond drilling the Hunton claims at Kirkland Lake, which he has under option. Mr. Chas. Spearman is in charge of operations.

Improved Service.—It is practically certain that when the new time table is arranged the Timiskaming and Northern Ontario railway will announce that the Cobalt special, the morning train from Toronto, will run through to Kirkland Lake and the Porcupine camp. This will be of great advantage to the mining industry and all that have to do business with these sections.

McIntyre—The annual report of the McIntyre Porcupine mines showed that $232,824 in bullion had been shipped during the year. The costs per ton milled were as follows: general charges, $.98.51; mining, $2.12.47; mine development, $1.95.92; milling, $1.53.64; total, $6.60.54. Total extraction is given as 91.65 per cent. The March report shows an extraction of 96.4 per cent. and milling costs $1.38.8. Mining costs for March are not given.

BOOK REVIEW.

ENGINEERING GEOLOGY, by Heinrich Ries and Thomas L. Watson. John Wiley & Sons (Canadian agents, Renouf Publishing Co., 25 McGill College Avenue, Montreal). Price, $4.00.

This book has been written primarily for civil engineers. The authors have for some years been giving to students of civil engineering in their respective universities a special course in geology as applied to engineering.

The chapter headings are, rock-forming minerals, rocks, structural features and metamorphism, rock-weathering and soils, surface waters, underground waters, landslides, wave action and shore currents, lakes, glacial deposits, building stone, limes, clay and clay products, coal, petroleum and natural gas, road foundations and materials, ore deposits.

There are 631 pages in the text. Illustrations are numerous and the book is well printed.

The authors have endeavored to keep before the reader the application of the topics treated to engineering work.

COBALT ORE SHIPMENTS.

Ore shipments were higher for the week ending June 5 than they have been for two years past for the same period. No less than twelve mines contributed and of these four despatched more than one car. The Coniagas despatched four cars of high grade concentrates so that the silver value of the shipments as well as the tonnage will be high.

The Aladdin Cobalt and the Trethewey each shipped two cars. The Aladdin, which controls the Chambers-Ferland, contributed one car of high grade and one car of table concentrates, which would not run very high in silver. The Trethewey also shipped one car of low and one of high grade ore. The Crown Reserve despatched 18 tons.

The ore shipments from the Cobalt camp for the week ending June 5 were:

	High.	Low.	Pounds.
Nipissing	.....	247,510	247,510
Aladdin-Cobalt	64,730	43,100	107,830
Trethewey	48,470	58,300	106,770
Coniagas	310,340	.....	310,340
McKinley-Dar.	80,880	.....	80,880
Cob. Lake	64,480	.....	64,480
Hudson Bay	.....	65,050	65,050
La Rose	78,780	.....	78,780
Dom. Red.	.....	84,600	84,600
Cr. Reserve	36,000	.....	36,000
Casey Cob.	60,000	.....	60,000
Townsite	85,500	.....	85,500
	829,180	498,560	1,327,740

MARKETS

STOCK QUOTATIONS.

(Courtesy of J. P. Bickell & Co., Standard Bank Bldg., Toronto, Ont.)

June 8, 1914.

New York Curb.	Bid.	Ask.
American Marconi	1.25	1.75
Alaska Gold	27.50	27.87
Braden Copper	7.75	8.00
British Copper	1.62	1.87
California Oil	326.00	328.00
Chino Copper	41.00	41.25
Giroux Copper	.50	1.00
Green Can.	32.00	34.00
Granby.	82.00	82.50
Miami Copper	22.12	22.50
Nevada Copper	14.25	14.37
Ohio Oil	181.00	182.00
Ray Cons. Copper	21.37	21.62
Standard Oil of N. Y.	217.00	218.00
Standard Oil of N. J.	411.00	413.00
Standard Oil (old)	1400.00	.....
Standard Oil (subs)	990.00	.....
Tonopah Mining	6.75	7.00
Tonopah Belmont	7.00	7.25
Tonopah Merger	.48	.51
Inspiration Copper	17.25	17.50
Goldfield Cons.	1.37	1.50
Yukon Gold	2.62	2.87
Porcupine Stocks.	**Bid.**	**Ask.**
Apex.	.02½	.03
Dome Extension	.07¾	.08
Dome Lake	.42	.42½
Dome Mines	7.75	8.00
Eldorado.	...	...
Foley-O'Brien	.28	.28½
Hollinger.	17.50	17.60
Jupiter	.10¼	.11
McIntyre.	.27½	.28
Moneta.	.02	.04
North Dome	...	...
Northern Exploration	2.25	2.75
Pearl Lake	.03½	.04
Plenaurum.	.40	.50
Porcupine Vipond	.28	.28½
Imperial.	.01½	.02
Porcupine Reserve	...	...
Preston East Dome	.01½	.02
Rea.	.10	.20
Standard.	...	...
Swastika	.01	.02
United.	...	...
West Dome	.06	.10
Porcupine Crown	.85	1.00
Teck Hughes	...	.10
Cobalt Stocks.	**Bid.**	**Ask.**
Bailey.	.00⅞	.01
Beaver.	.29	.29½
Buffalo	1.10	1.25
Canadian.	.08	.10
Chambers-Ferland.	.18	.18½
City of Cobalt	.43	.46
Cobalt Lake	.45	.50
Coniagas.	7.25	7.40
Crown Reserve	1.18	1.20
Foster.	.06	.08
Gifford.	.01	.02
Gould.	.01	.02
Great Northern	.07	.07½
Hargraves.	.01	.02
Hudson Bay	72.00	76.00
Kerr Lake	4.22	4.25
La Rose	1.42	1.44
McKinley.	.81	.83
Nipissing.	6.15	6.30
Peterson Lake	.38	.38½
Right of Way	...	.05
Rochester.	...	.02
Leaf.	.01	.02
Cochrane.	.30	.40
Silver Queen	...	.02
Timiskaming.	.15	.15½
Trethewey.	.17	.20
Wettlaufer.	.05	.06
Seneca Superior	2.50	2.80

TORONTO MARKETS.

June 10—(Quotations from Canada Metal Co., Toronto).
- Spelter, 5¼ cents per lb.
- Lead, 5.15 cents per lb.
- Tin, 34 cents per lb.
- Antimony, 8½ cents per lb.
- Copper, casting, 15 cents per lb.
- Electrolytic, 15 cents per lb.
- Ingot brass, 10 to 15 cents per lb.

June 10—Coal—(Quotations from Elias Rogers Co., Toronto).
- Anthracite, $7.50 per ton.
- Bituminous, lump, $5.25 per ton.

GENERAL MARKETS.

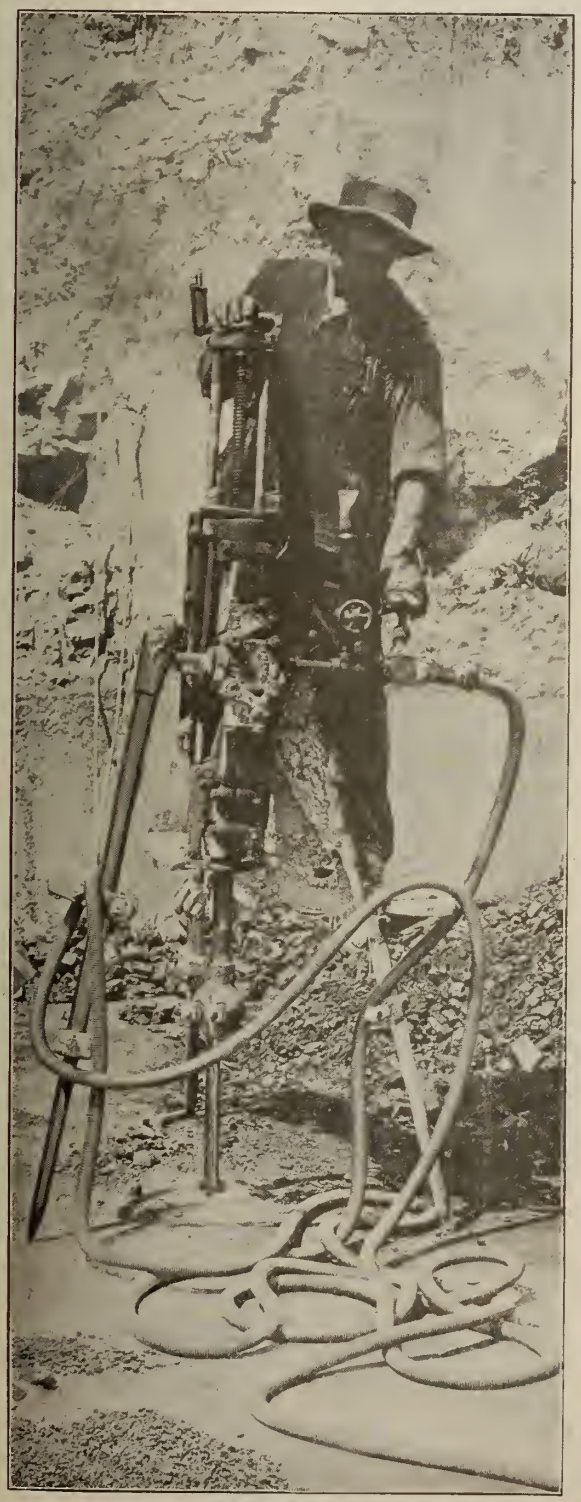
June 8—Connellsville Coke, (f.o.b. ovens).
- Furnace coke, prompt, $1.75 to $1.85 per ton.
- Foundry coke, prompt, $2.35 to $2.65 per ton.

June 8—Tin, straits, 30.80 cents.
- Copper, Prime Lake, 14.12½ to 14.37½ cents.
- Electrolytic copper, 13.90 to 14.00 cents.
- Copper wire, 15.25 cents.
- Lead, 3.90 cents.
- Spelter, 5.10 to 5.20 cents.
- Sheet zinc, (f.o.b. smelter), 7.00 cents.
- Antimony, Cookson's, 7.25 to 7.35 cents.
- Aluminum, 17.75 to 18.00 cents.
- Nickel, 40.00 to 45.00 cents.
- Platinum, soft, $43.00 to $44.00 per ounce.
- Platinum, hard, 10 per cent., $46.00 to $47.50 per ounce.
- Platinum, hard, 20 per cent., $49.00 to $51.50 per ounce.
- Bismuth, $1.95 to $2.15 per pound.
- Quicksilver, $38.00 per 75-lb. flask.

SILVER PRICES.

	New York cents.	London pence.
May 23.	57¼	26 7/16
" 25.	56½	25 15/16
" 26.	56¾	26 1/16
" 27.	57⅛	26¼
" 28.	57	26 1/16
" 29.	56⅞	26⅛
" 30.	Holiday	26
June 1.	56½	Holiday
" 2.	56⅛	25 13/16
" 3.	56⅛	25 13/16
" 4.	56½	25 15/16
" 5.	56⅛	25 13/16
" 6.	56¼	25 13/16
" 8.	56⅝	26
" 9.	56½	25 15/16
" 10.	56⅞	26⅛

Make Mine Equipment Pay Its Way



Put your mine equipment on a "personal efficiency basis. You would'nt hire a man for a responsible position just because he happened to be cheap.

Then why jeopardize the efficiency of your entire plant with poor equipment made to "meet a price", when Goodyear equipment is available for every specific purpose—made with the "service" idea—and therefore the most economical?

For price is only what you pay—service is what you get.

When buying hose, for instance, whether steam or air, remember that Goodyear efficiency experts have solved every problem of hose service.

This efficiency data is yours for the asking. It tells just what Goodyear hose—and why.

Goodyear experts will gladly confer with you at any time. Asking questions puts you under no obligation or expense.

GOODYEAR
TORONTO
HOSE FOR THE MINE

"Black Diamond" Brand

Has marlin woven jacket. A specially compounded tube for air—another for steam.

The marlin cover allows for perfect expansion —adds to the durability.

"Goodyear" Brand

An even higher grade hose than "Black Diamond." Same wearing quality on the outside but has a special steam and heat resisting tube. Made to resist the "cooking" which so quickly affects other hose. This Goodyear construction prevents rapid hardening of inner rubber tubing.

OTHER GOODYEAR PRODUCTS

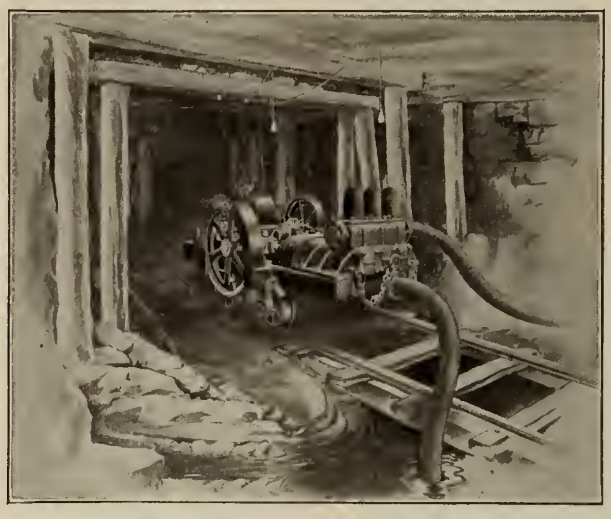
Goodyear Conveyor Belting, Transmission Belting, Packing and Valves are all made to meet exact needs, based on actual investigation, tests, and service.

Let Goodyear help you solve your equipment problems. Remember that Goodyear quality governs here as in auto tires.

Ask questions. Let Goodyear show you. Remember that these products are made in Canada in a plant where the standard is "Service Always."

THE GOODYEAR TIRE AND RUBBER COMPANY OF CANADA, LIMITED

Head Office, TORONTO Factory, Bowmanville, Ont.

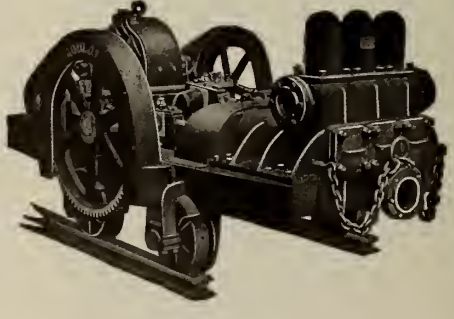


The dangers of mining are sufficiently great without increasing the risks by the use of unreliable equipment.

Goulds Reliable Pumps

will never fail to accomplish the work they are set to do. The electrically driven power pump illustrated has proven an ideal equipment for unwatering mines and other mine pumping services.

There is a Goulds Pump, centrifugal or triplex, for every mine pumping problem. Let our pump experts quote on the equipment to meet your particular requirements.



The Canadian Fairbanks-Morse Co. Limited

Montreal	St. John	Quebec	Ottawa	Toronto	Hamilton	Fort William
Winnipeg	Regina	Saskatoon	Calgary	Edmonton	Vancouver	Victoria

Canada's Departmental House for Mechanical Goods

PROFESSIONAL DIRECTORY.

The very best advice that the publishers of the Canadian Mining Journal can give to intending purchasers of mining stock is to consult a responsible Mining Engineer BEFORE accepting the prospectus of the mining company that is offered them. We would also strongly advise those who possess properties that show signs of minerals not to hesitate to send samples and to consult a chemist or assayer Those who have claims and who require the services of a lawyer, with a thorough knowledge of Mining Law, should be very careful with whom they place their business.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

Dominion of Canada.

Ontario

Astley, J. W.
Cohen, S. W.
Campbell & Deyell.
Carter, W. E. H.
Evans, J. W.
Ferrier, W. F.
Forbes, D. L. H.
Graham, S. N.
Gwillim, J. C.
Handley, John.
Hassan, A. A.
Haultain, H. E. T.
Hille, F.
Loring, F. C.
McEvoy, Jas.
Scott, G. S.
Segsworth, Walter E.
Smith, Alex H.
Smith, Sydney.
Maurice W. Summerhayes.
Tyrrell, J. B.

Quebec

Burchell, Geo. B.
Cohen, S. W.
DePencier, H. P.
Hardman, J. E.
Hersey, Milton L.
Johnson, W. S.
Smith, W. H.
Ross, J. G.

British Columbia

Brown & Butters.
Fowler, S. S.

FOREIGN-New York

Canadian Mining & Exploration Co., Ltd.
Colvocoresses, Geo. M.
Dorr, Jno. V.N.
Hassan, A. A.

ASSAYERS, CHEMISTS AND ORE TESTERS.

Dominion of Canada

Ontario

Belleville Assay Office.
Campbell & Deyell
Heys, Thos. & Son
Canadian Laboratories, Ltd.

Quebec

Hersey, Milton Co., Ltd
Dr. J. T. Donald

Foreign-New York

Ledoux & Co.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

ASTLEY, J. W.
Consulting Mining Engineer,
24 King Street West,
TORONTO, CANADA.
Phone M, 129, Code: Bedford McNeill

CARTER & SMITH
Consulting Mining Engineers
448-449 Confederation Life B'ldg
TORONTO
W. E. H. Carter B.A. Sc. Alex. H. Smith, M.I.M.M.

FERRIER, W. F.
Mining Engineer and Geologist
204 Lumsden Bldg., Toronto, Ont.
General Manager, Natural Resources Exploration Co., Limited.

BROWN & BUTTERS
Mining Geologists and Metallurgical Engineers
PRINCE RUPERT, B.C.

COHEN, SAMUEL W., E. M.
Consulting Engineer,
Room 601, Dom. Express Bldg. Montreal
General Manager,
Crown Reserve Mining Co. Ltd.
Cobalt, Can.

FOWLER, S. S.
Mining Engineer,
NELSON, B. C.

BURCHELL, GEO. B.
Mining Engineer
Lignite and Bituminous Coal Mining
Examinations and Reports
505 McGILL BLDG., MONTREAL
Cable Address "Minchel" Phone Main 6737

Colvocoresses, George M.,
Mining Engineer
43 Exchange Place - New York City
General Manager
Consolidated Arizona Smelting Co.,
Humboldt, Ariz.

FORBES, D. L. H.
Mining & Metallurgical Engineer
306 Manning Chambers, Toronto, Ont.
Mine Examination and Consultation.
Metallurgical Engineer for Merrill Metallurgical Co.

Canadian Mining and Exploration Co., Ltd.
Consulting Mining Engineers.
Mines and Prospects Purchased and Financed.
42 Exchange Place, New York
Canadian Offices:
Traders Bank Building, Toronto
Drake Block, Victoria, B.C.

DEPENCIER, H. P.
Consulting Mining Engineer
ROOM 613, DOMINION EXPRESS BLDG.,
MONTREAL.
PHONE MAIN 4984 P. O. BOX 763

GRAHAM, STANLEY N., B.Sc.
Mining Engineer
HALIFAX, N.S.

EVANS, J. W.
Mining Engineer,
Mines and Mining Properties examined and reported upon.
BELLEVILLE, ONTARIO.

GUESS & HAULTAIN
Mining & Metallurgical Engineers
123 Bay Street
TORONTO CANADA

PROFESSIONAL : DIRECTORY.

CONTINUED FROM PRECEDING PAGE.

ENGINEERS, METALLURGISTS AND GEOLOGISTS.

GWILLIM, J. C.
Consulting Mining Engineer,
KINGSTON, ONT.

HANDLEY, JOHN
Mining Engineer and Metallurgist
SUDBURY, ONT.
Code: Bedford McNeill, 1908.

HARDMAN, J. E.
Consulting Mining Engineer
MONTREAL, CANADA.

HASSAN, A. A., COBALT, ONT.
Mining Geologist and Consulting Engineer.
61 WALDORF COURT, BROOKLYN, N. Y.
Examination, Management and Operation of Mines in Ontario, Quebec and Nova Scotia.
Any Code. Cable Address: "Asghar"

HILLE, F.
Mining Engineer.
Mines and Mineral Lands Examined and Reported On.
Port Arthur, Ontario, Canada.

Phones { Office Main 6935 / Res Lachine 218
JOHNSON, W. S.
CONSULTING MINING ENGINEER
Canada Life Bldg, MONTREAL.

LORING, FRANK C.
Mining Engineer,
Home Life Building, Toronto, Ont.
Cobalt, Ont.

MCEVOY, JAMES
Mining Engineer,
Stair Building,
TORONTO.

PICKINGS, H. B.
Mining Engineer
METROPOLE BUILDING
HALIFAX, N.S.

ROSS, JAS. G., B. Sc. McGill,
M. Amer. Inst. M. E.
Consulting Mining Engineer,
MILTON HERSEY CO., LTD.
171 St. James St., MONTREAL.

SCOTT, G. S. TORONTO
Mining Engineer and Geologist
Valuations and General Reports.
Development of Ore Bodies Planned and supervised.
Geological Surveys.
Detail Prospecting of Properties Superintended.
Examination of Prospects.
Microscopic Examination of Rocks.
Care Canadian Mining Journal

JOHN V. N. DORR
Consulting and Metallurgical Engineer
30 Church Street - New York City
and
First National Bank Building, Denver, Colorado.

SEGSWORTH, WALTER E.
Mining Engineer,
103 BAY ST., TORONTO.
PHONE MAIN 2311

SMITH, SYDNEY.
Mining Engineer,
HAILEYBURY, ONT.

SUMMERHAYES, MAURICE W.
Mining Engineer,
Manager
Porcupine-Crown Mines, Limited
Timmins - Ont.

TYRRELL, J. B.
Mining Engineer,
534 Confederation Life Building,
TORONTO, - - CANADA.

What is your specialty ?
What is your address ?
Our readers want to know.

LAWYERS

Telephone Main 3813
Cable Address: "Chadwick" Toronto Western Union Code
E. M. Chadwick, K.C
David Fasken, K.C.
M. K. Cowan, K.C.
Harper Armstrong
Alexander Fasken
Hugh E. Rose, K.C.
Geo. H. Sedgewick.
James Aitchison
Beatty, Blackstock, Fasken Cowan & Chadwick
Barristers, Solicitors, Notaries
Offices: Bank of Toronto, Cor. Wellington & Church Sts.
58 Wellington St. East
Toronto

G. G. S. Lindsey, K.C.
Telephone Main 6070
Cable Address: "Lindsey," Toronto Codes, Broomhall, McNeil's 1908
Commissioner for taking affidavits in British Columbia.
counsel with
Gregory & Gooderham,
Barristers and Solicitors,
Canada Life Building,
Toronto

Phone Main 2311
Cable Address "Segsworth" Toronto
R. F. SEGSWORTH
Barrister, Solicitor, Notary, Etc.
JARVIS BUILDING
103 Bay Street - TORONTO

ASSAYERS, CHEMISTS AND ORE TESTERS.

MILTON HERSEY CO. LTD.
Chemists and Mining Engineers,
Dr. Milton L. Hersey, President.
Consulting Chemist to Quebec Govt.
ASSAYS OF ORES.
Chemical, Electrical and Mechanical Tests of all Materials.
JAS. G. ROSS, B. Sc, M. A. I. M. E.
Consulting Mining Engineer.
Head Office:
171 St. James St., Montreal.

Phone M. 1889 Cable address "Heys"
Established 1873.
HEYS, THOS. & SON,
Technical Chemists and Assayers,
124 Yonge Street, Toronto, Ont.
Sampling Ore Deposits a Specialty.

LEDOUX & CO. (Inc.)
Ore Samplers and Assayers,
Office and Laboratory,
99 John St., New York.
Public Ore and Metal Samplers at the Port of New York.
We are not brokers or dealers, but receive consignments; weigh, sample and assay them, and attend to settlement, collection and remittance on behalf of sellers.

SMITH & DURKEE Diamond Drilling Co.
LIMITED
Contractors for all classes of diamond drill work.
We make a specialty of saving a large percentage of core in soft ground.
Plans showing location of holes and surveys of holes can be supplied.
SUDBURY - ONT.

CAMPBELL & DEYELL, Limited
Ore Samplers, Assayers and Chemists
Cobalt, Ont.
South Porcupine, Ont.
C. G. CAMPBELL,
General Manager.

CANADIAN LABORATORIES LIMITED
ASSAYERS AND CHEMISTS
ASSAY OF ORES
All commercial products tested and analyzed
OFFICES AND LABORATORIES.
24 ADELAIDE STREET WEST
TORONTO, ONT.

HUGH BOYLE, SECY. JAS. E. BOYLE, MGR.
DOMINION DIAMOND DRILLING CO., Ltd.
SOUTH PORCUPINE, ONT.
Telephone 213 Box 506
CORE BORING SOUNDINGS CONTRACTORS

Laboratory of
DR. J. T. DONALD
(Official Analyst to Dominion Government)
ASSAYS OF ORES
Analyses and tests of all kinds of commercial products. Cement Testing, Coal, &c.
318, Lagauchetiere St. West, MONTREAL

Smith & Travers Diamond Drill Company, Limited
Box 169, SUDBURY, ONT.
404 Lumsden Bldg., TORONTO.
All classes of Diamond Drill Contracting and Manufacture of Diamond Drill Parts.

Belleville Assay Office
Assays and Analyses of Ores and Minerals.
OFFICE AND LABORATORY,
185 Pinnacle St. Belleville, Ont.

WANTED—DRAUGHTSMAN familiar with Mill Work. State Experience and Salary Wanted.
Moose Mountain, Limited, Sellwood, Ont.

Mine superintendent, foreman, surveyor and assayer, with fifteen years experience, open for engagement.
Address Box 5, Can. Mining Journal, Toronto.

Import firm at Hamburg, Germany, with first class references wishes to enter into further business connections.
Apply Box 98, Canadian Mining Journal

The Canadian Mining Journal
WITH WHICH IS INCORPORATED "THE CANADIAN MINING REVIEW"
A JOURNAL DEVOTED TO MINING AND METALLURGY
SUBSCRIPTION IN CANADA, $2.00
TO OTHER COUNTRIES, $3.00
PUBLISHED ON THE FIRST AND FIFTEENTH OF EACH MONTH
TWENTY-FOUR ISSUES IN A YEAR

The Canadian Mining Journal,
Toronto, Ontario, Canada.

Send me the Canadian Mining Journal for one year and until countermanded, beginning with the month of.....for which I agree to pay the sum of.....Dollars per year.

Name .....

Address .....

.....

DEPARTMENT OF MINES GEOLOGICAL SURVEY.

PUBLICATIONS

The Geological Survey has published maps and reports dealing with a large part of Canada, with many local areas and special subjects.

A catalogue of publications will be sent free to any applicant. A single copy of a map or report that is specially desired will be sent to a Canadian applicant free of cost and to others at a nominal price. The applicant should state definitely the precise area concerning which information is desired, and it is often of assistance in filling an order for a map or report if he states the use for which it is required.

Most of the older reports are out of print, but they may usually be found in public libraries, libraries of the Canadian Mining Institute, etc.

REPORTS RECENTLY ISSUED:

CANADA

1240. Victoria Memorial Museum Bulletin No. 1. Contains short scientific papers.

NEW BRUNSWICK and NOVA SCOTIA

Memoir 20. Gold fields of Nova Scotia, by W. Malcolm.
Memoir 44. Clay and Shale Deposits of New Brunswick, by J. Keele.

QUEBEC

Memoir 43. St. Hilaire (Beloeil) and Rougemont mountains, Quebec, by J. J. O'Neill.

ONTARIO

Memoir 33. Geology of Gowganda Mining Division, by W. H. Collins.

NORTH-WEST PROVINCES

Memoir 30. The basins of Nelson and Churchill rivers, by William McInnes. Map not published.
Memoir 52. Geological Notes to Accompany Map of Sheep River Gas and Oil Field, Alberta, by D. B. Dowling.

BRITISH COLUMBIA

Memoir 23. Geology of the coast and islands between the Strait of Georgia and Queen Charlotte Sound, B.C., by J. Austen Bancroft.
Memoir 36. Geology of the Victoria and Saanich Map areas, Vancouver Island, B.C., by Chas. H. Clapp. Maps not published.

YUKON AND NORTH-WEST TERRITORIES

Memoir 31. Wheaton District, Yukon Territory, by D. D. Cairnes. Maps not yet published.

MAPS RECENTLY ISSUED:

CANADA

Map 91A. Geological map of the Dominion of Canada and Newfoundland. Scale 100 miles to 1 inch.

NEW BRUNSWICK AND NOVA SCOTIA

Map 26A. Bathurst and vicinity, Gloucester County, New Brunswick. Topography.
Map 27A. Bathurst and vicinity, Gloucester County, New Brunswick. Geology.
Map 39A. Geological Map of Nova Scotia.

QUEBEC

Map 95A. Broadback River, Mistassini territory, Quebec. Geology.
Map 100A. Bell River, Quebec. Geology.

ONTARIO

Map 98A. Rainy Lake, Rainy River District, Ontario. Geology.
Map 49A. Orillia sheet, Simcoe and Ontario counties, Ontario. Topography.

NORTH-WEST PROVINCES

Map 55A. Geological map of Alberta, Saskatchewan, and Manitoba.
Map 96A. Wanipigow, Manigotagan, and Oiseau Rivers, Manitoba. Geology.
Map 103A. Southfork Coal Area, Old Man River, Alberta. Geology.
Map 107A. Blairmore, Alberta. Geology.

BRITISH COLUMBIA

Map 43A. Sooke Sheet, Vancouver Island, British Columbia. Topography.
Map 65A. Coast and islands between Strait of Georgia and Queen Charlotte Sound, British Columbia. Geology.
Map 92A. Coast and Islands between Queen Charlotte Sound and Burke Channel, British Columbia. Geology.
Map 99A. Southern portion of Cranbrook map area, East and West Kootenay, British Columbia. Geology.
Map 104A. Thompson River Valley, below Kamloops Lake, British Columbia. Geology.
Map 106A. Groundhog coal field, British Columbia. Geology.

YUKON AND NORTH-WEST TERRITORIES.

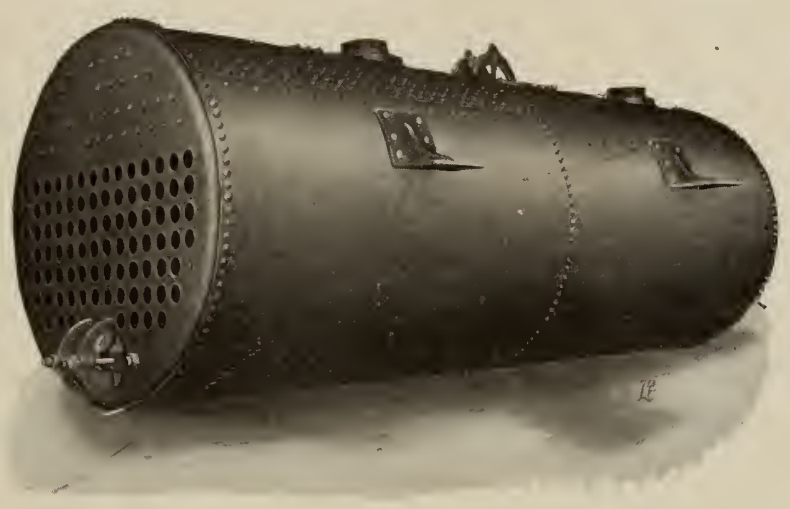
Map 113A. Canadian routes to White River District, Yukon, and to Chisana District, Alaska.

NOTE.—Maps published within the last two years may be had, printed on linen, for field use. A charge of ten cents is made for maps on linen.

The Geological Survey will, under certain limitations, give information and advice upon subjects relating to general and economic geology. Mineral and rock specimens, when accompanied by definite statements of localities, will be examined and their nature reported upon. Letters and samples that are of a Departmental nature, addressed to the Director, may be Mailed O.H.M.S. free of postage.

Communications should be addressed to THE DIRECTOR, GEOLOGICAL SURVEY, OTTAWA.

BOILERS



"INGLIS" STANDARD RETURN TUBULAR BOILER

We make Boilers of all kinds for any service.

For Fifty-two (52) years our boilers have been recognized as the Canadian Standard because they combine all the essentials requisite to produce the best boiler.

It is a pleasure for us to show prospective buyers our different types of boilers in operation.

WRITE US FOR PRICES AND SPECIFICATIONS

The John Inglis Co.,
LIMITED

Engineers and Boilermakers

14 Strachan Avenue TORONTO Canada

Montreal Office: Room 509 Canadian Express Building.

BUYERS AND SELLERS OF METALS

The Consolidated Mining and Smelting Company of Canada, Limited

Offices, Smelting and Refining Department
TRAIL, BRITISH COLUMBIA

SMELTERS AND REFINERS

Purchasers of all classes of Ores.

Producers of Fine Gold and Silver, Base Bullion, Copper Matte, Pig Lead, Lead Pipe, Bluestone and Electrolytic Bearing Metal.

Oldest Experts in
Molybdenite
Scheelite
Wolframite
Chrome Ore
Nickel Ore
Cobalt Ore
Cerium, and all Ores and Minerals
Talc
Mica
Barytes
Graphite
Blende
Corundum
Fluorspar
Feldspar

GEO. G. BLACKWELL, SONS & CO., Limited
Metallurgists, Mine Owners, Merchants, Manufacturers
THE ALBANY, LIVERPOOL, ENGLAND

Largest Buyers, Best Figures, Advances on Shipments, Correspondence Solicited

CABLES—Blackwell, Liverpool, ABC Code, Moreing & Neal Mining and General Code, Lieber's Code, and Muller's Code.

ESTABLISHED BY GEO. C. BLACKWELL. 1869

HENRY BATH & SON, Brokers
London, Liverpool and Swansea
ALL DESCRIPTION OF . . . . . **METALS, MATTES, Etc.**

Warehouses, LIVERPOOL and SWANSEA.
Warrants issued under their Special Act of Parliament.

NITRATE OF SODA. Cable Address, BATHOTA, London

Deloro Mining and Reduction Co., Limited

Smelters and Refiners
BUYERS OF SILVER—COBALT ORES

Manufacturers of White Arsenic and Cobalt Oxide
Smelter and Refinery at Deloro, Ontario

Branch Office : 1111 C.P.R. Building
Cor. King and Yonge Sts., Toronto

MOLYBDENITE

90% PURE
WANTED

E. SCHAAF-REGELMAN,

21 State Street - New York, N.Y.

The Coniagas Reduction Company, Limited.

St. Catharines - - Ontario

Smelters and Refiners of Cobalt Ores

Manufacturers of
Bar Silver, White Arsenic, Cobalt Oxide and Nickel Oxide

Telegraphic Address: "Coniagas"
Codes: Bedford McNeill A.B.C. 5th Edition
Bell Telephone 603, St. Catharines

Balbach Smelting and Refining Co. Newark, N. J.

Buyers of
Gold, Silver, Lead and Copper Ores.
Lead Residues and Copper Residues.

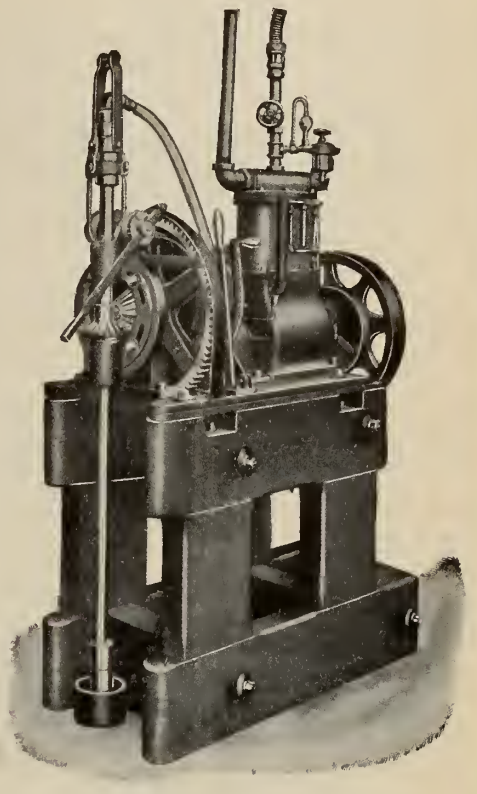
Electrolytic Copper Refinery

INQUIRIES SOLICITED

McKIERNAN-TERRY

CORE DRILLS

The McKiernan-Terry Core Drill is to-day almost universally regarded as not only the one absolutely accurate means of determining the exact geological formation, but it is also considered, and rightfully so, as providing the cheapest method of arriving at such determinations. Metal miners, coal miners and contractors have all testified to the merits of our core drill, and have backed up their testimony by its exclusive adoption for their work. Our catalogue contains a complete description of these drills, and also the results of actual work as well as comparative tests.



Sole Agents for Canada

CANADIAN ALLIS-CHALMERS

Limited

Head Office: TORONTO. District Sales Offices: MONTREAL, HALIFAX, OTTAWA, COBALT, PORCUPINE, FORT WILLIAM, WINNIPEG, REGINA, SASKATOON, CALGARY, EDMONTON, NELSON, VICTORIA, VANCOUVER, PRINCE RUPERT.

PROVINCE OF QUEBEC

Department of Colonization, Mines, and Fisheries

The chief minerals of the Province of Quebec are Asbestos, Chromite, Copper, Iron, Gold, Molybdenite, Phosphate, Mica, Graphite, Ornamental and Building Stone, Clays, Etc.

The Mining Law gives absolute security of Title and is very favourable to the Prospector.

MINERS' CERTIFICATES. First of all, obtain a miner's certificate, from the Department in Quebec or from the nearest agent. The price of this certificate is $10.00, and it is valid until the first of January following. This certificate gives the right to prospect on public lands and on private lands, on which the mineral rights belong to the Crown.

The holder of the certificate may stake mining claims to the extent of 200 acres.

WORKING CONDITIONS. During the first six months following the staking of the claim, work on it must be performed to the extent of at least twenty-five days of eight hours.

SIX MONTHS AFTER STAKING. At the expiration of six months from the date of the staking, the prospector, to retain his rights, must take out a mining license.

MINING LICENSE. The mining license may cover 40 to 200 acres in unsurveyed territory. The price of this license is Fifty Cents an acre per year, and a fee of $10.00 on issue. It is valid for one year and is renewable on the same terms, on producing an affidavit that during the year work has been performed to the extent of at least twenty-five days labour on each forty acres.

MINING CONCESSION. Notwithstanding the above, a mining concession may be acquired at any time at the rate of $5 an acre for SUPERIOR METALS, and $3 an acre for INFER IOR MINERALS.

The attention of prospectors is specially called to the territory in the North-Western part of the Province of Quebec, north of the height of land, where important mineralized belts are known to exist.

PROVINCIAL LABORATORY. Special arrangements have been made with POLYTECHNIC SCHOOL of LAVAL UNIVERSITY, 228 ST. DENIS STREET, MONTREAL, for the determination, assays and analysis of minerals at very reduced rates for the benefit of miners and prospectors in the Province of Quebec. The well equipped laboratories of this institution and its trained chemists ensure results of undoubted integrity and reliability.

The Bureau of Mines at Quebec will give all the information desired in connection with the mines and mineral resources of the Province, on application addressed to

THE HONORABLE THE MINISTER OF COLONIZATION, MINES, AND FISHERIES, QUEBEC.

Ontario's Mining Lands

There are many millions of acres in Eastern, Northern, and Northwestern Ontario where the geological formations are favorable for the occurrence of minerals, the pre-Cambrian series being pre-eminently the metal-bearing rocks of America.

The phenomenally rich silver mines of Cobalt occur in these rocks; so also do the far-famed nickel-copper deposits of Sudbury, the gold of Porcupine, and the iron ore of Helen, Magpie, and Moose Mountain.

Many other varieties of useful minerals are found in Ontario:—cobalt, arsenic, iron pyrites, mica, graphite, corundum, talc, gypsum, salt, petroleum, and natural gas.

Building materials such as brick, lime, stone, cement, sand and gravel, are abundant.

The output of the mines and metallurgical works of Ontario for the year 1912 was valued at $48,341,612, and for 1913 this amount will be materially increased.

The prospector can go almost anywhere in the mineral regions in his canoe; the climate is invigorating and healthy, and there is plenty of wood and good water.

A miner's license costs $5.00 per annum, and entitles the holder to stake out three claims a year in every mining division.

For maps, reports of the Bureau of Mines, and mining laws, apply to

HON. W. H. HEARST,
Minister of Lands, Forests and Mines,
Toronto, Canada.

ALPHABETICAL INDEX TO ADVERTISERS

A

Ackroyd & Best 2
Allan, Whyte & Co. 2
American Diamond Rock Drill Co. 16
Astley, J. W. 23

B

Balbach Smelting & Refining Co.. 28
Bartlett, C. O., & Snow Co. 17
Bath, Henry & Son 28
Beatty, Blackstock, Fasken, Cowan & Chadwick 24
Beatty, M. & Sons, Ltd. 11
Belleville Assay Office 25
Bennett, Wm., Sons & Co., Ltd.... 13
Berger, C. L. & Sons 16
Blackwell,. Geo. G., Sons & Co. ... 28
British Columbia, Province of ... 18
Brown & Butters 23
Burchell, Geo. B. 23
A. M. Byers Co .....
.....inside front cover

C

Canadian Allis-Chalmers, Limited.. 29
Campbell & Deyell 25
Canadian Cleveland Drill Co 9
Canadian Copper Co. 8
Canadian Explosives, Ltd. 33
Canadian Fairbanks-Morse Co., Ltd. 22
Canadian Laboratories, Ltd. 25
Canadian Northern Steamships ... 6
Canadian Ingersoll-Rand Co., Ltd... 3
Canadian Mining & Exploration Co., Ltd. 23
Canada Metal Co. 11
Canadian Westinghouse Co. 36
Carter & Smith 23
Cohen, S. W. 23
Colvocoresses, G. M. 23
Consolidated Mining & Smelting Co 28
Coniagas Reduction Co., Ltd. 28
Curtis's & Harvey .....
.....Outside back cover
Canadian H. W. Johns-Manville Co. Ltd. 9

D

Dept. of Mines, Canada 26
Deloro Mining & Reduction Co... 28
DePencier, H. P. 23
Diamond Drill Contracting Co..... 16
Dominion Coal Co., Ltd. 8
Dominion Diamond Drilling Co., Ltd. 25
Dominion Bridge Co. 16
Donald, Dr. J. T. 25
Dorr, Jno. V. N. 24
Drury, H. A. Co., Ltd. 15
Dwight & Lloyd Metallurgical Co. 18

E

Electric Steel & Metals Co., Ltd. .. 8
Evans, J. W. 23

F

Ferrier, W. F. 23
Fleck, Alex. 6
Flory, S., Mfg. Co. 12
Forbes, D. L. H. 23
Fowler, S. S. 23
Fraser & Chalmers of Can., Ltd.... 4
Federal Engineering Co., Ltd. 31

G

Goodyear Tire & Rubber Co. of Can. Ltd. 21
Graham, S. N. 23
Gray, John 25
Greening, B., Wire Co., Ltd. 10
Gwillim, J. C. 24

H

Hadfields Steel Foundry Co. 7
Handley, John 24
Hardman, J. E. 24
Hassan, A. A. 24
Haultain, H. E. T. 23
Hersey, Milton Co., Ltd. 25
Heys, Thos. & Son 25
Hille, F. 24
Holman Drill Co. 20

I

Inglis, John & Co., Ltd. 27
Imperial Bank of Canada 11
Industrial & Technical Press, Ltd.. 13
International Nickel Co. 8

J

James Ore Concentrator Co. .....
.....Outside back cover
Jeffrey Manufacturing Co. 19
Jenckes Machine Co. 5
Johnson, W. S. 24
Jones & Glassco 19

K

Krupp, Fried. A. G., Germany 17

L

Laurie & Lamb 17
Ledoux & Co. 25
Loring, F. C. 24
Lymans, Limited 9
Lands of the Algoma Central and Hudson Bay Ry. 36
Lindsey, G. G. S. 24

M

Herbert Morris Crane & Hoist Co., Ltd. 16
Morton, B. K. & Co. 18
McEvoy, James 24
Mussens, Limited .....
.....20 and front cover
Michigan College of Mines 6

N

Nova Scotia Steel & Coal Co. 10
Nova Scotia, Province of 15
Northern Canada Supply Co., Ltd. 6

O

Orford Copper Co. 8
Ontario, Province of 30

P

Peacock Bros. 7
Pickings, H. B. 24
Pyke, James W. & Co., Ltd. 17

Q

Quebec, Province of 29

R

Rock & Power Mach., Ltd. 1
Roessler & Hasslacher Chemical Co. 31
Ross, James G. 24

S

Schaaf-Regelman, E. 28
Scott, G. S. 24
Segsworth, W. E. 24
Siemens Co. Canada Ltd. 35
Smart-Turner Machine Co. 12
Smart-Woods, Ltd. 13
Smith & Durkee Diamond Drill Co. 25
Smith & Travers Diamond Drill Co. 25
Smith, Thos. & Wm., Ltd. .....
.....Inside back cover
Smith, Sydney 24
Standard Diamond Drill Co. 16
Standard Underground Cable Co. of Can. Ltd. 15
Sullivan Machinery Co. 2
Summerhayes, Maurice W. 24
Swedish Steel & Importing Co., Ltd. 12

T

Geo. Taylor Hardware Co., Ltd.... 4
Tyrrell, J. B. 24

W

Walker Bros. 7

TRADE MARK
LANCO BALATA
BELTING

Lanco Balata Belting

Use this Belting on your wet drives and for elevating wet material.
This Belt is made as well as it is possible to make a Balata Belt.

If required endless we can make them up at our own warehouse.

FEDERAL ENGINEERING CO., Limited
TORONTO MONTREAL

The Roessler & Hasslacher Chemical Co.

100 William Street, NEW YORK

THE ROESSLER & HASSLACHER CHEMICAL COMPANY
CHEMISTS
NEW YORK

Cyanide 98/99 per cent.

Cyanide of Sodium 128/130 per cent.

Cyanide of Sodium 120 per cent. In Brick form.

The Canadian Miner's Buying Directory.

Air Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.
Jenckes Machine Co., Ltd.

Amalgamators—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried A. G., Germany
Northern Canada Supply Co.

Assayers and Chemists—
Milton L. Hersey Co., Ltd.
Campbell & Deyell, Cobalt
Ledoux & Co., 99 John St., New York
Thos. Heys & Son.

Assayers' and Chemists' Supplies—
C. L. Berger & Sons, 37 William St., Boston, Mass.
Lymans, Ltd., Montreal, Que.
Stanley, W. F. & Co., Ltd
Peacock Bros.
Geo. Taylor Hardware Co,Ltd

Bags—
Smart-Woods, Ltd.

Ball Mills—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
The John Inglis Co., Ltd.

Beams—Steel—
Canadian Allis-Chalmers, Ltd
Dominion Bridge Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Belting—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Northern Canada Supply Co.
Jones & Glassco
Canadian Fairbanks-Morse
Federal Engineering Co.,
G. Taylor Hardware Co., Ltd.

Blasting Batteries and Supplies—
Canadian Allis-Chalmers, Ltd
Thomas & William Smith
Can. Ingersoll-Rand Co., Ltd
Curtis & Harvey (Canada), Limited.
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Blowers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Boilers—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Waterous Engine Works Co.,
Canadian Fairbanks-Morse Co., Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Can. Ingersoll-Rand Co., Ltd
The John Inglis Co., Ltd.

Buckets—
Rock & Power Mach'y, Ltd.
Peacock Bros.
M. Beatty & Sons, Ltd.
Waterous Engine Works.
Mussens, Ltd.
Northern Canada Supply Co.

Buildings—Steel Frame—
Dominion Bridge Co.
Canadian Allis-Chalmers, Ltd

Cable — Aerial and Underground—
G. Taylor Hardware Co., Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Cableways—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Cages—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Jenckes Machine Co., Ltd.

Cables—Wire—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.
Siemens Co. of Canada, Ltd.

Canvas—
Smart-Woods, Ltd.
G. Taylor Hardware Co., Ltd.

Cars—
Jeffrey Mfg. Co.
Mussens, Ltd.
Northern Canada Supply Co.

Cement Machinery—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Krupp, Fried. A. G., Germany
Jenckes Machine Co., Ltd.
Northern Canada Supply Co.
Peacock Bros.

Chains—
Jeffrey Mfg. Co.
Peacock Bros.
Jones & Glassco
Mussens, Ltd.
Canadian Fairbanks-Morse Co.
B. Greening Wire Co., Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Chain Crane—
The Herbert Morris Crane & Hoist Co., Ltd.

Chain Blocks—
The Herbert Morris, Crane & Hoist Co., Ltd.

Chain Clutches—
The Herbert Morris Crane & Hoist Co., Ltd.

Chemists—
Canadian Laboratories.
Campbell & Deyell
Thos. Heys & Son
Milton Hersey Co.
Ledoux & Co.

Coal—
Dominion Coal Co.
Nova Scotia Steel & Coal Co.

Coal Cutters—
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Mussens, Ltd.

Coal Handling Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Coal Mining Explosives—
Curtis & Harvey (Can.), Ltd.

Coal Mining Machinery—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd.
Fraser & Chalmers, Ltd.
Peacock Bros.
Jeffrey Mfg. Co.

Coal Punchers—
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Coal Washeries—
Jeffrey Mfg. Co.
Mussens, Ltd.
Peacock Bros.

Compressors—Air—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Canadian Allis-Chalmers, Ltd
Laurie & Lamb
Canadian Westinghouse
Can. Ingersoll-Rand Co. Ltd.
Cleveland Pneumatic Tool Co. of Canada, Ltd.
Mussens, Ltd.
Peacock Bros.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Concentrators and Jigs—
Rock & Power Mach'y, Ltd.
Fraser & Chalmers, Ltd.
James Ore Concentrator Co.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Canadian Fairbanks-Morse
Jenckes Machine Co., Ltd.

Concrete Mixers—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Condensers—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.,
Peacock Bros.
Laurie & Lamb
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Converters—
Canadian Westinghouse
Fraser & Chalmers, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
Peacock Bros.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Waterous Engine Works

Conveying Machinery—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Mussens, Ltd.
Canadian Fairbanks-Morse Co., Ltd.
M. Beatty & Sons, Ltd.
Krupp, Fried. A. G., Germany

Cranes—Electric—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Overhead Traveling—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Crane Ropes—
Allan, Whyte & Co.
Thos. & Wm. Smith
B. Greening Wire Co., Ltd.
G. Taylor Hardware Co., Ltd.

Cranes—Swing Jib—
The Herbert Morris Crane & Hoist Co., Ltd.

Cranes—Wall—
The Herbert Morris Crane & Hoist Co., Ltd.

Crushers—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Lymans, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Hadfields Steel Foundry Co.

Cyanide Plants—
Jenckes Machine Co., Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roessler & Hasslacher
Thos. & Wm. Smith
Peacock Bros.

Derricks—
Rock & Power Mach'y, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
M. Beatty & Sons, Ltd.
Mussens, Ltd.

Diamond Drill Contractors—
Diamond Drill Contracting Co.
Smith & Travers.

Dredging Machinery—
Canadian Allis-Chalmers, Ltd
Peacock Bros.
M. Beatty & Sons.
Mussens, Ltd.

Dredging Ropes—
Allan, Whyte & Co.
Fraser & Chalmers, Ltd.
B. Greening Wire Co., Ltd.

Drills, Air and Hammer—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Can. Ingersoll-Rand Co., Ltd
Mussens, Ltd.
Jeffrey Mfg. Co.
Sullivan Machinery Co.
Peacock Bros.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Drills—Core—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Standard Diamond Drill Co.

Drills—Diamond—
American Diamond Rock Drills
Sullivan Machinery Co.
Northern Canada Supply Co.

Drill Steel Sharpeners—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Drills—Electric—
Canadian Allis-Chalmers, Ltd
Mussens, Ltd.
Siemens Co. of Canada, Ltd.
Can. Ingersoll-Rand Co., Ltd

Dump Cars—
Sullivan Machinery Co.
Waterous Engine Works Co.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Siemens Co. of Canada, Ltd.

Conveyors—Belt—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd

Dynamite—
Curtis & Harvey (Canada), Ltd.
Canadian Explosives
Northern Canada Supply Co.

Dynamos—
Can. Westinghouse Co.
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Electric Cranes—
The Herbert Morris Crane & Hoist Co., Ltd.

Elevating and Conveying Machinery—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Ejectors—
Mussens, Ltd.
Peacock Bros.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Elevators—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Jeffrey Mfg. Co.
Krupp, Fried. A. G., Germany
M. Beatty & Sons
Sullivan Machinery Co.
Northern Canada Supply Co.
Waterous Engine Works.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Peacock Bros.

Engineering Instruments—
C. L. Berger & Sons
Peacock Bros.

Engineers and Contractors—
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Roberts & Schaefer Co.

Engines—Automatic—
Smart-Turner Machine Co.
Peacock Bros.
Waterous Engine Works Co.
The John Inglis Co., Ltd.

Engines—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Mussens, Ltd.
Alex. Fleck
Sullivan Machinery Co.
Smart-Turner Machine Co.
Peacock Bros.
M. Beatty & Sons
Canadian Westinghouse
John Inglis & Co., Ltd.
Can. Fairbanks-Morse Co.

Engine—Haulage—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Peacock Bros.

Engines—Marine—
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Engines—Oil—
Rock & Power Mach'y, Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.

Engines—Steam—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Smart-Turner Machine Co.
S. Flory Mfg. Co.
Peacock Bros.
M. Beatty & Sons
Laurie & Lamb
Mussens, Ltd.
Can. Fairbanks-Morse Co.
The John Inglis Co., Ltd.

Fans—Ventilating—
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Sullivan Machinery Co.
Peacock Bros.
Mussens, Ltd.

Feeders—Ore—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.

Filters—
Krupp, Fried, A. G., Germany

Friction Hoists—
Rock & Power Mach'y, Ltd.
The Herbert Morris Crane & Hoist Co., Ltd.

Forges—
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Northern Canada Supply Co., Ltd.

Forgings—
M. Beatty & Sons
Canadian Cleveland Drill Co.
Smart-Turner Machine Co.
Peacock Bros.

Continued on page 34.

Canadian Explosives, Limited

Head Office - - - MONTREAL, P.Q.
Main Western Office - VICTORIA, B.C.

SUCCESSORS TO

Hamilton Powder Co. Ontario Powder Co. Acadia Powder Co.
Standard Explosives Ltd. Western Explosives Ltd.

This stamp

means quality

DYNAMITE

For Railroad and Quarry work

FORCITE

For hard rock mining—wet or dry.
Less fumes than any other explosive.

District Offices :

NOVA SCOTIA : - - - - - - Halifax
QUEBEC : - - - - - - Montreal
ONTARIO : Toronto, Cobalt, South Porcupine, Port Arthur, Kingston
MANITOBA : - - - - - - Winnipeg
ALBERTA : - - - - - - - Edmonton
BRITISH COLUMBIA : Vancouver, Victoria, Nelson, Prince Rupert

Distributing magazines at all district office points,
also throughout all the Provinces of Canada.

Factories at

Beloeil, P.Q., Vaudreuil, P.Q., Windsor Mills, P.Q., Waverley, N.S., Nanaimo, B.C.
Northfield, B.C., Bowen Island, B.C., Parry Sound, Ont.

Canadian Miner's Buying Directory.—(Continued from page 32.)

Furnaces—Assay—
Krup, Fried. A. G., Germany
Lymans, Ltd.
Mussens, Ltd.

Fuse—
Peacock Bros.
Curtis & Harvey, (Canada), Limited
Canadian Westinghouse
Canadian Explosives
Mussens, Ltd.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Gears—
Canadian Westinghouse
Krupp, Fried. A G., Germany
Smart-Turner Machine Co.
Northern Canada Supply Co.
The John Inglis Co., Ltd.

Generators—
Canadian Westinghouse
Northern Electric Co., Ltd.
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.

Hangers—Cable—
Northern Electric Co., Ltd.
Standard Underground Cable Co. of Canada, Ltd.

Hand Hoists—
The Herbert Morris Crane & Hoist Co., Ltd.

Heaters—Feed Water—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Laurie & Lamb
Canadian Westinghouse
Peacock Bros.
Fraser & Chalmers, Ltd.
G. Taylor Hardware Co., Ltd.

High Speed Steel Twist Drills—
Mussens, Ltd.
Northern Canada Supply Co.

Hoists—Air Electric and Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co., Ltd
Peacock Bros.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
S. Flory Mfg. Co.
Jones & Glassco
Waterous Engine Works
M. Beatty & Sons
Can. Fairbanks-Morse Co.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.
Siemens Co. of Canada, Ltd.

Hoists, Chain, Electric and Pneumatic—
The Herbert Morris Crane & Hoist Co., Ltd.

Hoisting and Conveying Machinery—
Rock & Power Mach'y, Ltd.
Jenckes Machine Co., Ltd.

Hoisting Engines—
Rock & Power Mach'y, Ltd.
Canadian Allis-Chalmers, Ltd
Peacock Bros.
Can. Fairbanks-Morse Co.
Siemens Co. of Canada, Ltd.
Sullivan Machinery Co.
Fraser & Chalmers, Ltd.
Can. Ingersoll-Rand Co.

Hoists—Gas and Gasoline—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Waterous Engine Works.

Hose—
H. W. Johns-Manville Co.
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Cleveland Drill Co.
Northern Canada Supply Co.
G. Taylor Hardware Co., Ltd.

Jacks—
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Ingersoll-Rand Co., Ltd
Northern Canada Supply Co.

Jigs—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Canadian Allis-Chalmers, Ltd
Roberts & Schaefer Co.

Lamps—Acetylene—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Northern Canada Supply Co.

Lamps—Safety—
Canadian Explosives
Peacock Bros.
Ackroyd & Best
Siemens Co. of Canada, Ltd.

Link Belt—
Waterous Engine Works
Northern Canada Supply Co.
Jones & Glassco

Locomotives—Electric—
Mussens, Ltd.
Jeffrey Mfg. Co.
Canadian Westinghouse
Siemens Co. of Canada, Ltd.

Locomotives—Steam—
Mussens, Ltd.
Canadian Westinghouse

Metal Merchants—
Henry Bath & Son
Geo. G. Blackwell Sons & Co.
Consolidated Mining and Smelting Co. of Canada
Canada Metal Co.

Monel Metal—
Orford Copper Co.

Motors—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Northern Electric Co., Ltd.
Can. Fairbanks-Morse Co.
G. Taylor Hardware Co., Ltd.
Canadian Westinghouse
Peacock Bros.
Siemens Co. of Canada, Ltd.

Ore Sacks—
Can. Fairbanks-Morse Co.
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Ore Testing Works—
Ledoux & Co.
Can. Laboratories
Milton Hersey Co., Ltd.
Campbell & Deyell

Ores and Metals—Buyers and Sellers of—
Geo. G. Blackwell.
Consolidated Mining and Smelting Co. of Canada
Krupp, Fried, A. G., Germany
Orford Copper Co.
Canada Metal Co.

Perforated Metals—
B. Greening Wire Co., Ltd.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pick Machines—
Sullivan Machinery Co.

Picks—Steel—
Mussens, Ltd.
G. Taylor Hardware Co., Ltd.
Thos. & Wm. Smith
Peacock Bros.

Pipes—
Consolidated M. & S. Co.
Peacock Bros.
G. Taylor Hardware Co., Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Smart-Turner Machine Co.
The John Inglis Co., Ltd.
A. M. Byers Co.

Pipe Fittings—
Can. H. W. Johns-Manville
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Canadian Westinghouse
Northern Canada Supply Co.
Geo. Taylor Hardware Co,Ltd

Pneumatic Chain Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Pneumatic Tools—
Can. Cleveland Drill Co.
Can. Ingersoll-Rand Co., Ltd.
G. Taylor Hardware Co., Ltd.
Jones & Glassco

Producer—Gas—
Krupp, Fried, A. G., Germany
Mussens, Ltd.

Prospecting Mills and Machinery—
Rock & Power Mach'y, Ltd.
Standard Diamond Drill Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Can. Fairbanks-Morse Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.

Pulleys, Shaftings and Hangings—
G. Taylor Hardware Co., Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Northern Canada Supply Co.

Pumps—Boiler Feed—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Northern Canada Supply Co.
Peacock Bros.
Laurie & Lamb
Fraser & Chalmers, Ltd.

Pumps—Centrifugal—
Rock & Power Mach'y, Ltd.
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Smart-Turner Machine Co.
Peacock Bros.
Thos. & Wm. Smith
M. Beatty & Sons
Can. Ingersoll-Rand Co., Ltd.
Laurie & Lamb
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Electric—
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Jeffrey Mfg. Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.
Siemens Co. of Canada, Ltd.

Pumps—Pneumatic—
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Ingersoll-Rand Co., Ltd.
Rock & Power Mach'y, Ltd.
Can. Fairbanks-Morse Co.
Mussens, Ltd.
Can. Ingersoll Rand Co., Ltd.

Pumps—Steam—
Rock & Power Mach'y, Ltd.
Can. Ingersoll-Rand Co. Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Northern Canada Supply Co.
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.
G. Taylor Hardware Co., Ltd.
The John Inglis Co., Ltd.

Pumps—Turbine—
Rock & Power Mach'y, Ltd.
Krupp, Fried, A. G., Germany
Mussens, Ltd.
Smart-Turner Machine Co.
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
The John Inglis Co., Ltd.

Pumps—Vacuum—
Can. Fairbanks-Morse Co.
Smart-Turner Machine Co.

Quarrying Machinery—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Can. Cleveland Drill Co.
Krupp, Fried. A. G., Germany
Sullivan Machinery Co.
Can. Ingersoll-Rand Co., Ltd.

Rails—Mine—
H. A. Drury Co., Ltd.

Roasting Plants—
Can. Allis-Chalmers, Ltd.
Fraser & Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Rolling Mill Machinery—
Krupp, Fried. A. G., Germany

Rolls—Crushing—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd.
Can. Allis-Chalmers, Ltd.

Roofing—
Paterson Mfg. Co.
Dominion Bridge Co.
Mussens, Ltd.
Northern Canada Supply Co.
Can. H. W. Johns-Manville
Geo. Taylor Hardware Co,Ltd

Rope Blocks—
The Herbert Morris Crane & Hoist Co., Ltd.

Rope—Manilla and Jute—
Jones & Glassco
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Northern Canada Supply Co.
Allan, Whyte & Co.
Thos. & Wm. Smith, Ltd.

Rope—Wire—
B. Greening Wire Co.
Allan, Whyte & Co.
Northern Canada Supply Co.
Thos. & Wm. Smith
Fraser & Chalmers, Ltd.

Rubber—
Canadian Consolidated Rubber Co., Ltd.
G. Taylor Hardware Co., Ltd.

Runways, Hand Operated—
The Herbert Morris Crane & Hoist Co., Ltd.

Samplers—
Canadian Laboratories
Ledoux & Co.
Milton Hersey Co.
Krupp, Fried. A. G., Germany
Thos. Heys & Son

Screens—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Jeffrey Mfg. Co.
Northern Canada Supply Co.
R. Greening Wire Co.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Waterous Engine Co.
Fraser & Chalmers, Ltd.
Jenckes Machine Co., Ltd.

Separators—
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Smart-Turner Machine Co.
Peacock Bros.
The John Inglis Co., Ltd.

Separators—Magnetic—
Krupp, Fried. A. G., Germany

Shear Legs—
The Herbert Morris Crane & Hoist Co., Ltd.

Shovels—Steam—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
M. Beatty & Sons

Slime Tables—
Deister Concentrator Co.
James Ore Concentrator
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Smelting Machinery—
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.

Stamp Mills—
Jenckes Machine Co., Ltd.
Rock & Power Mach'y, Ltd.
Krupp, Fried. A. G., Germany
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Can. Fairbanks-Morse Co.
Peacock Bros.
Fraser & Chalmers, Ltd.

Steel Drills—
Rock & Power Mach'y, Ltd.
Sullivan Machinery Co.
Northern Canada Supply Co.
Krupp, Fried. A G., Germany
Can. Ingersoll-Rand Co., Ltd.
Peacock Bros.
Swedish Steel & Imp. Co., Ltd
G. Taylor Hardware Co., Ltd.

Steel—Tool—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Thos. & Wm. Smith
Can. Fairbanks-Morse Co.
Krupp, Fried. A. G., Germany
N. S. Steel & Coal Co.
Swedish Steel & Imp. Co. Ltd

Surveying Instruments—
Peacock Bros.
W. F. Stanley
C. L. Berger

Switchboards—
Canadian Westinghouse
Can. Allis-Chalmers, Ltd.
Northern Electric Co., Ltd.
Siemens Co. of Canada, Ltd.

Tanks—Cyanide, Etc.—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Peacock Bros.
Fraser & Chalmers, Ltd.
Jenckes Machine Co., Ltd.

Tramways—
Mussens, Ltd.
B. Greening Wire Co.
Can. Allis-Chalmers, Ltd.

Transformers—
Canadian Westinghouse
Can. Fairbanks-Morse Co.
Northern Electric Co., Ltd.
Peacock Bros.
Siemens Co. of Canada, Ltd.

Transits—
C. L. Berger & Sons
Peacock Bros.

Tractors—Oil—
Can. Fairbanks-Morse Co.,

Tube Mills—
Rock & Power Mach'y, Ltd.
Mussens, Ltd.
Krupp, Fried. A. G., Germany
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.

Turbines—
Rock & Power Mach'y, Ltd.
Canadian Westinghouse
Peacock Bros.
Laurie & Lamb
Can. Allis-Chalmers, Ltd.
Siemens Co. of Canada, Ltd.
Krupp, Fried. A. G., Germany
Fraser & Chalmers, Ltd

Water Wheels—
Can. Allis-Chalmers, Ltd.
Krupp, Fried. A. G., Germany

Winding Engines—
Rock & Power Mach'y, Ltd.
Waterous Engine Works
Mussens, Ltd.
Can. Allis-Chalmers, Ltd.
Peacock Bros.
Fraser & Chalmers, Ltd.
Siemens Co. of Canada, Ltd.

Wire Cloth—
G. Taylor Hardware Co., Ltd.
Mussens, Ltd.
Northern Canada Supply Co.
B. Greening Wire Co.

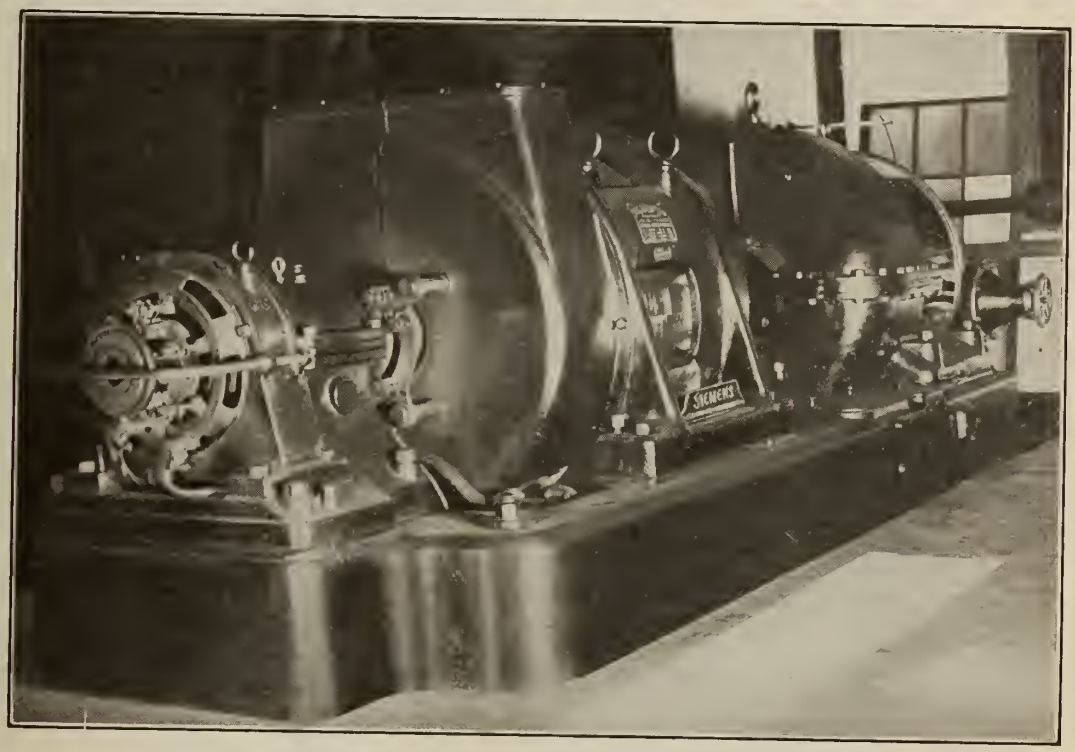
Wire (Bare and Insulated)—
Northern Electric Co., Ltd.
Standard Underground Cable Co., of Canada, Ltd.

Zinc Dust—
Roessler & Hasslacher.

SIEMENS BROS. DYNAMO WORKS | SIEMENS BROS. & CO.

SIEMENS

SIEMENS—SCHUCKERT | SIEMENS & HALSKE



Siemens 750 K.W., 3,600 R.P.M. Turbo Generator supplied to the Nova Scotia Steel and Coal Company, Nova Scotia.

The following Siemens **Turbo Generators** have been supplied or are on order for Canada.

1—4000 K.W. Edmonton.
1—3000 K.W. Regina.
1—2500 K.W. Dominion Coal Co.
1—2000 K.W. Dawson City
1—2000 K.W. Dawson City.
1—2000 K.W. Dawson City.
1—2000 K.W. Edmonton.
1—1500 K.W. Regina.
1—1500 K.W. Moose Jaw.
1—1500 K.W. Regina.
1—1200 K.W. Lethbridge.
1— 750 K.W. Nova Scotia Steel & Coal Co.
1— 675 K.W. Medicine Hat.
1— 675 K.W. Medicine Hat.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Nova Scotia Steel & Coal Co.
1— 500 K.W. Wayagamack Pulp & Paper Co.

The Siemens Companies undertake the complete electrical equipment of Mines, Power Houses and Transformer Stations.

Siemens Company of Canada, Limited

HEAD OFFICE
TRANSPORTATION BUILDING - MONTREAL

BRANCH OFFICES:

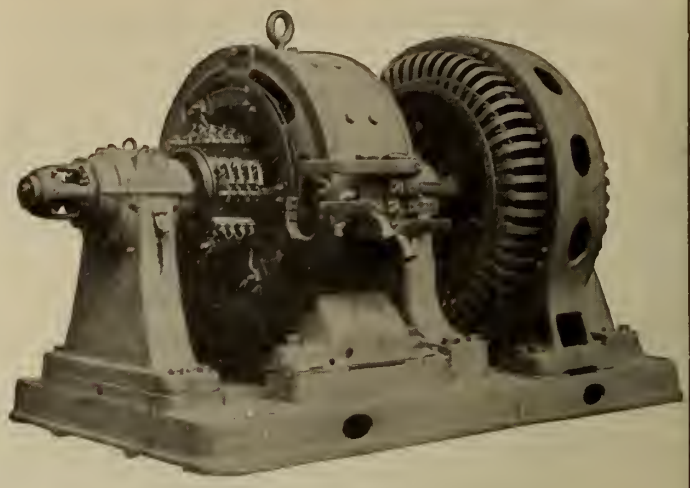
STANDARD BANK BUILDING
TORONTO

McARTHUR BUILDING
WINNIPEG

The thoroughly successful performance in mine sub-stations of

Westinghouse Motor Generator Sets

is due to the fact that they were designed only after a careful study of power requirements in mines; and long experience in the application of electrical apparatus.



Westinghouse 100 KW, Self-Starting, Synchronous Motor Generator Set

Some of their advantages are:

Sparkless commutation over a wide range of load and overload.
High efficiency at all loads, particularly on fractional loads.
Simplicity combined with strength.
High power factor at all loads.
Minimum attention required.

These are a few of the many excellent features embodied in the design of Westinghouse Motor Generator Sets for mine sub-stations.

Our nearest office will furnish further information promptly upon request.

Canadian Westinghouse Co., Limited, Hamilton, Ont.

TORONTO Traders Bank Bldg. | MONTREAL 52 Victoria Sq. | OTTAWA Ahern & Soper, Ltd. | HALIFAX Telephone Bldg. | WINNIPEG 158 Portage Ave. E. | CALGARY Grain Exchange Bldg. | VANCOUVER Bank of Ottawa Bldg.

LANDS OF THE ALGOMA CENTRAL & HUDSON BAY RAILWAY

Opened for Prospecting

Two thousand square miles of railway lands in the Lake Superior region that have been held in reserve during the construction of the A. C. & H. B. Railway are now open for public prospecting.

No license is required; staking, recording and assessment work practically as on Government lands. Perpetual mining rights obtainable under renewable leases on easy royalty. The lands are in alternate blocks with intervening areas of Government lands which are also open for prospecting. Two passenger trains daily through the district.

— FOR REGULATIONS, MAPS, ETC., APPLY TO —

JOHN A. DRESSER,
Manager, Lands Dept., A. C. & H. B. Ry.,
Sault Ste. Marie, Canada

THE DAILY
JOURNAL OF COMMERCE

Hon. W. S. Fielding, Editor-in-Chief
J. C. Ross, M.A., Managing Editor

Should be read by all who desire to keep in touch with the Industrial, Commercial and Financial progress of Canada.

— Published by —
THE INDUSTRIAL & EDUCATIONAL PRESS, Limited
35-45 St. Alexander St., Montreal 44-46 Lombard St., Toronto
— which also publishes —
CANADIAN MINING JOURNAL *Editor: Reginald E. Hore, B.A.*
CANADIAN TEXTILE JOURNAL *Editor: E. Stanley Bates*
PULP AND PAPER MAGAZINE OF CANADA *Editor: A. Gordon McIntyre, B.A., B.Sc.*
CANADIAN MILLER AND CEREALIST *Editor: J. G. Adams, B.A.*
CANADIAN FISHERMAN *Editor; F. Wm. Wallace*
These are the only periodicals in Canada covering her basic industries.

THOS. & WM. SMITH, LTD.,

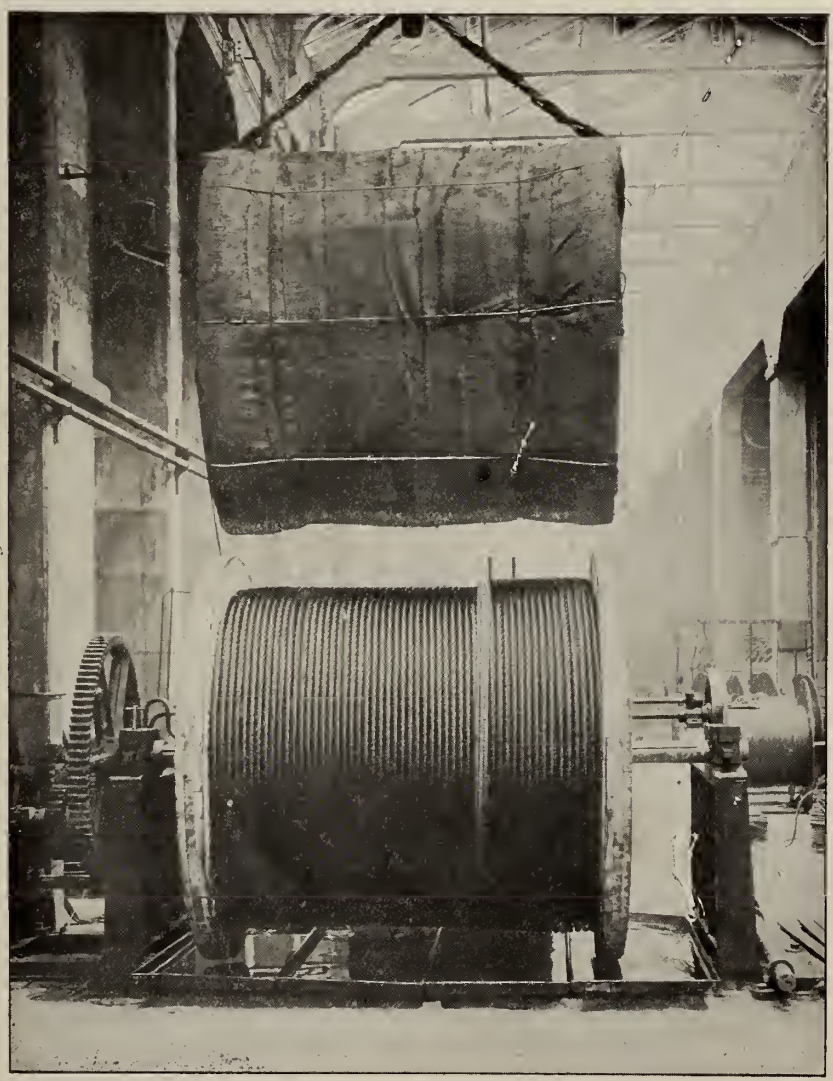
WIRE ROPE MANUFACTURERS,

NEWCASTLE-ON-TYNE, ENGLAND.

STEEL WIRE ROPES (RED THREAD BRAND.)

For **MINING:—**
Winding, Hauling, etc.

Also Aerial Cableways,
Cranes, Dredges, etc.



Two Reels of Wire Rope for a Colliery Company in Nova Scotia, each 10,000 feet long, 1⅛" diameter, and weighing ten tons each.

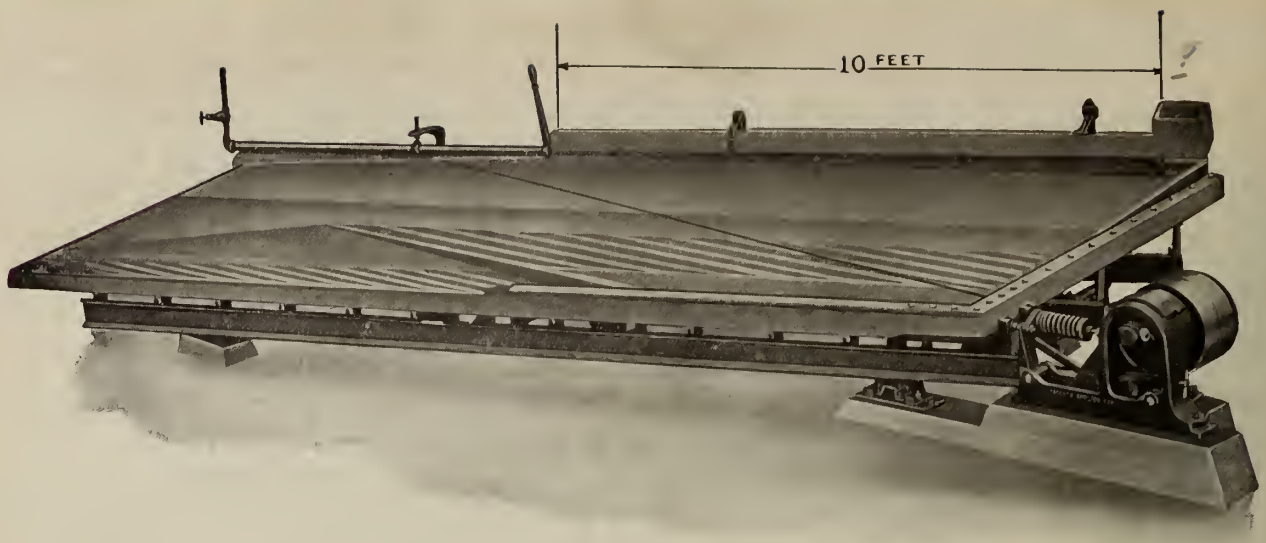
MODERN AND UP-TO-DATE APPLIANCES
for dealing rapidly and efficiently with Wire Ropes of any weight.

CANADIAN REPRESENTATIVE:

D. W. CLARK, 49 Common Street, Montreal, P.Q., CANADA.

AGENTS.

EVANS, COLEMAN & EVANS, Ltd., Vancouver, B.C.
ANGEL ENGINEERING & SUPPLY CO., Ltd., St. John's, N.F.
CANADIAN B. K. MORTON CO., Ltd., Montreal.
BAINES & PECKOVER, Toronto Ont.



The James Diagonal Plane Slimer, Patented

The James Diagonal Plane Slimer Has Proven Its Superiority Over Its Competitors In The Cobalt District. This table is manufactured in New Glasgow, Nova Scotia, for the Canadian Market, and Newark, N.J. for the United States and Mexican Markets.

The following are users of the JAMES TABLES in this district.

Nipissing Reduction Works. Buffalo Mines. Temiskaming Mining Co., Ltd.
Hudson Bay Mines, Ltd. Trethewey Silver Cobalt Mining Co., Ltd.
Beaver Consolidated Mines, Ltd. The O'Brien Mines.

James Ore Concentrator Company, 35 Runyon St. NEWARK, N.J.

IT
Will Pay You to Use

CURTIS'S & HARVEY (CANADA) LIMITED
D.C.L.
DRAGON BRAND

Explosives

For location of Magazine nearest to your Property

Write to
400 St. James St.
MONTREAL